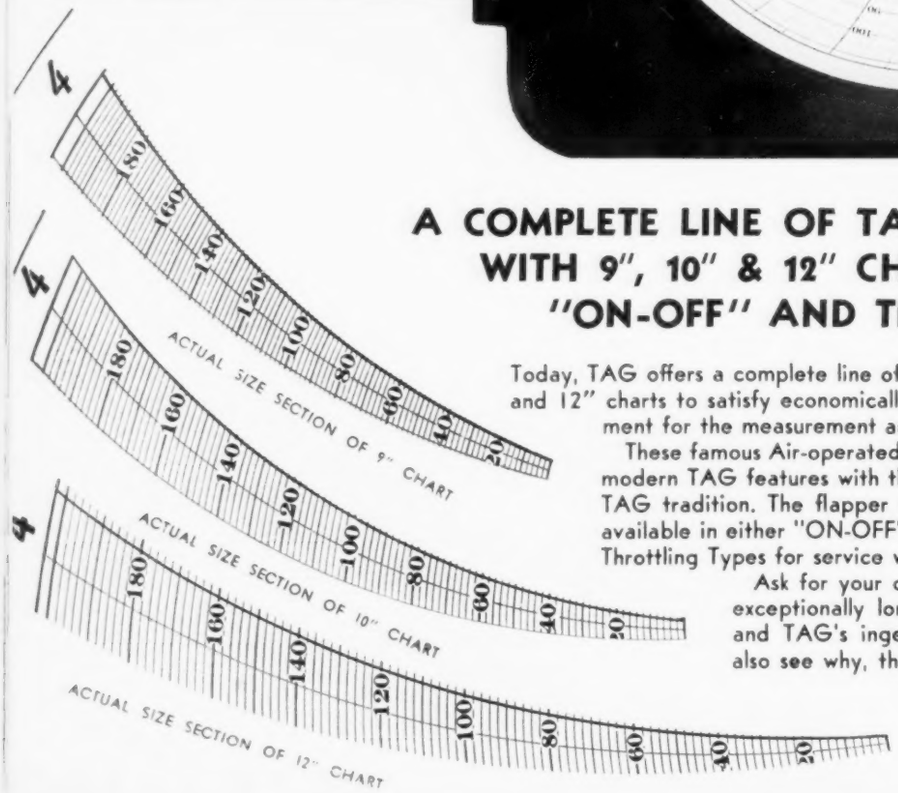
Instruments

THE MAGAZINE OF Measurement and Control

Vol. 12
DEC.
1939
No. 11

The Service of Temperature Supervision in YOUR Plant



A COMPLETE LINE OF TAG RECORDER - CONTROLLERS WITH 9", 10" & 12" CHARTS AND MODELS FOR "ON-OFF" AND THROTTLING CONTROL!

Today, TAG offers a complete line of modern Recorder-Controllers, using 9", 10" and 12" charts to satisfy economically and with certainty every industrial requirement for the measurement and control of process temperatures.

These famous Air-operated Control Instruments embody all the exclusive, modern TAG features with the dependable precision which has become a TAG tradition. The flapper mechanism has been redesigned and is now available in either "ON-OFF" Control Models for most industrial needs or Throttling Types for service where apparatus lag is present.

Ask for your copy of Catalog 1060-I . . . learn about the exceptionally long pen travel in these Recorder-Controllers and TAG's ingenious, interchangeable tube system. You'll also see why, throughout Industry where the maintenance of product quality and uniformity is the watchword, the TAG imprimatur is to be seen on panel boards in steadily increasing numbers.

C. J. TAGLIABUE MFG. CO.

Park & Nostrand Ave's., Brooklyn, N. Y.

TAG LIABUE BROOKLYN N.Y. U.S.A.

PRECISION PORTABLES

(Electrodynamometer type accurate within ¼ of 1%) for critical test work. Available for AC and DC in Voltmeters (single, double and triple range), Ammeters, Milliameters, Wattmeters, etc.

ELECTRIC TACHOMETERS

Indicators calibrated in R.P.M. or in other units. Widely used on pumping and conveyor systems, ovens, kilns, etc. Several indicators can be mounted to one magneto, and mounted where desired.

PHOTRONIC ILLUMINATION METERS

The standard instruments for plant illumination level tests. Also special high-sensitivity instruments for photo-metric research; and Photronic controllers for turning lights on and off at predetermined levels.

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Double pivoted type, for measurement of minute currents in radio, electro chemistry, etc. Available in single or multi-ranges as DC Millivoltmeters and Microammeters . . . and DC or Thermo Milliammeters, Ammeters and Voltmeters.

TO MEET EACH MEASUREMENT NEED *Exactly!*

Whether the need arises in the field of industrial research, modern production or maintenance testing, or in other specialized fields . . . it will pay you to check with WESTON. For with a complete coverage of all the types, sizes, ranges and operating specifications, WESTON is in a position to supply an instrument *exactly* suited to your measurement need. Moreover, the fundamentals of *precision* and *dependability* add further justification for making any selection "WESTON". Further details will be gladly furnished upon request. Weston Electrical Instrument Corporation, 591 Frelinghuysen Ave., Newark, N. J.

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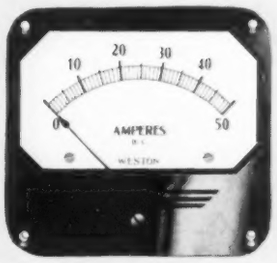
Available as Volt-Ohmmeters, Volt-Ohm-Ammeters, and other combinations, including radio tube checking. Ideal for use in production assembly and inspection. Also available in pocket-size, multi-range instruments.

AC CLAMP-AMMETER

A time-saver in maintenance work. Current reading obtained simply by placing clamping jaws around conductor. Circuits never disturbed. 6 current ranges. High insulation for complete protection.



PANEL AND SWITCHBOARD INSTRUMENTS

Available in round, rectangular and fan shapes; in various sizes to meet all requirements from large switchboards to small control panels . . . as well as for all "built-in" needs.

● **You owe it to yourself to apply the quality yardstick to condensers you use—especially if in quantities. Also, to save time, trouble, expense, you need the best means of checking condensers, inductances and radio-frequency circuits under conditions simulating actual use. Hence these two suggestions:**

● AEROVOX Bridge is popular-priced instrument originally intended for servicemen but now found in many labs. and plants. Costs only $35.75, yet incorporates high-grade meter in place of usual neon-lamp indicator.

Invaluable for checking capacity, power factor, insulation resistance, leakage, etc. of condensers. Also checks resistances.

Because of high-grade meter and variable power supply, externally available, this bridge serves a lot of functions beyond the usual bridge, such as power supply, vacuum-tube voltmeter, voltmeter, millivoltmeter, milliammeter, etc.

No lab. is complete without a bridge. This one is sufficiently accurate for most of the work of condenser users.

● L-C Checker does many important things, yet costs only $29.50 net.

Most attractive feature is way it checks condensers right in their circuits—without disconnecting or unsoldering—at operative radio frequencies. It's a real *radio* test—and a time saver. Checks for capacity, opens, shorts, intermittents. Also checks inductances, circuits, frequency resonant points, etc.

Tremendous help in aligning r.f. and i.f. stages; tuning traps; checking chokes; checking natural period of antennae and r.f. transmission lines, etc.

Truly the "miracle" radio test instrument and indispensable regardless of its low price.

See them . . .

● Your local AEROVOX jobber can show you both instruments. Ask to see them. Ask for data. Or write us direct.

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Instruments
THE MAGAZINE OF MEASUREMENT and CONTROL

Vol. 12 No. 12

DECEMBER 1939

FRONT COVER: Dust-proof room in instrument shop at Cheyenne Maintenance Base of United Air Lines. (See page 320)

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Straws In The Wind

A FEW days ago we re-read Part One of last January's issue of *Instruments* with a definite purpose: to try, after a nearly-fatal illness which made us "lose the page," to grasp in full "What Instruments Do for American Industry." (That was the January theme, you remember, and there were seventeen articles—a general one by National Research Project engineers, the others by authorities in specific fields.) We re-read with a fresh mind all these articles which we had edited eleven months ago. We achieved our purpose only partly—because it would take a colossal intelligence to grasp the entire picture in all its details and evaluate all the benefits of Instrumentation in all the leading industries.

Dig out *your* own copy and re-read it: you will find these "what instruments do" articles as valuable as if written a week ago!

In addition to serving as a memory-refreshing course, the study of these 48-week-old articles, in conjunction with recent contacts, brought out the rapid progress being made at the present time by every instrument-using industry: certain specifically descriptive statements would no doubt be revised by their authors in the light of tremendous advance made in the last few months. You may confirm this for yourself by re-reading the particular article reporting what instruments do in your own industry; here and there, where the author says that something is being done, you will no doubt say to yourself that it has been done.

The underlying causes—inventories, legislation, war, etc.—are difficult to analyze. It is safe to assert, however, that the immediate cause is a keener interest in measurement and control on the part of executives, technicians, engineering professors, economists, technical societies—even government officials. For example, in his article on the textile industry in last January's issue, H. F. Perkins, of the Pacific Mills, had mentioned the textile schools, but who would have thought a year ago that Massachusetts would inaugurate a textile instrument course? Well, here it is:

MASSACHUSETTS DEPARTMENT OF EDUCATION
DIVISION OF UNIVERSITY EXTENSION

Two Massachusetts University Extension courses, "Rayon and Synthetic Fibers" and "Instruments for Consumer and Industrial Testing," will be offered by the State Department of Education during the coming winter months. Both courses will be given by Erwin J. Saxl, Consulting Physicist and Chemist, on Tuesday evenings, starting January 23, at the Massachusetts Institute of Technology, Building 1, 77 Massachusetts Ave., Cambridge. . . . The course on "Instruments for Consumer and Industrial Testing," meets at 6:30 p.m., and will offer instruction in the methods of determining the value of materials purchased, whether raw products for industry, such as wires, textiles and rubber, or consumer goods such as textile materials and finished rubber products. It will also present the data necessary for a scientific basis of comparison of different products, materials, and claims, and will discuss methods of standardization and recording by the aid of testing instruments in industrial production, purchasing and selling. Actual testing instruments in action will be demonstrated.

Information concerning these courses may be obtained by writing James A. Moyer, Director, Division of University Extension, State Education Building, Newbury and Exeter Streets, Boston.

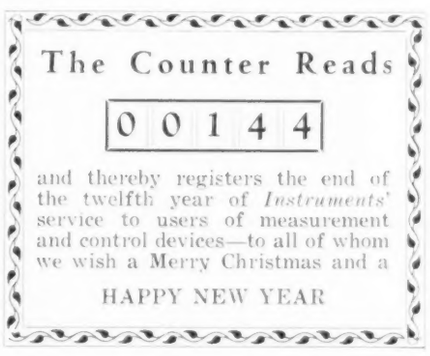
As to scientific, engineering, and other organizations, a significant recent event is the spontaneous formation of the American Society for Measurement and Control by young instrument men employed in various industries. When we say "spontaneous" we mean just that: this society came into being without stimulation by instrument-makers; and we were not aware of its existence until its president wrote us last July. Among other organized activities, the success of the Temperature Symposium in New York Nov. 2 to 4 was largely due to a growing general instrument-mindedness, as witness the following account:

The Symposium on Temperature, its Measurement and Control in Science and Industry, held by the American Institute of Physics in coöperation with the National Bureau of Standards, National Research Council and a large group of Engineering Societies in New York on Nov. 2, 3 and 4th, was very successful and well attended. The registration was approximately 600 and included engineers and scientists from all over the country. The symposium was held in 19 sessions including a general session at which Dr. John T. Tate, Chairman of the Institute welcomed the assembly and at which Dr. Lyman J. Briggs, Director of the National Bureau of Standards presided. At this general session a paper of special interest to industrial engineers was presented by L. O. Sordahl of the U. S. Steel Corporation on "The Pyrometry of Liquid Steel in the Open Hearth Furnace."

Of the 127 papers presented, a large fraction dealt with the application of physics in industry, principally in the oil industry and the high-temperature industries. Another large group of papers included theoretical topics in general science, precision thermometry, automatic control and instruments. The universal interest in temperature was strikingly shown in this symposium in which there were three sessions on medical and biological subjects, including a paper on the "Temperature of the Human Body in Health and Disease" by Dr. Eugene F. DuBois, a nationally known authority on metabolism.

The symposium papers will be published in book form, probably in two volumes, within a few months. They will constitute the most comprehensive text on temperature since the pyrometry symposium of twenty years ago.

C. O. FAIRCHILD, Chairman
Advisory Committee


The Counter Reads
00144
and thereby registers the end of the twelfth year of *Instruments'* service to users of measurement and control devices—to all of whom we wish a Merry Christmas and a
HAPPY NEW YEAR

As to technical societies, it is significant that the American Society for Metals bestowed its Sauveur Award this year on Stanley P. Rockwell, inventor of hardness testing and dilatometric instruments. In fact, nearly all engineering societies are expanding their activities related to instruments. For example, here is a brief report on the annual meeting of the A.S.M.E. last week, received just as we go to press:

At the ASME Annual meeting in Philadelphia, Dec. 4-8, there were presented the following papers of interest to the readers of *Instruments*.

1. "The Principles of Instrument Design" by C. S. Draper of M.I.T. and Geo. Bentley of the Waltham Watch Co., which continues the recent paper in *Instruments* by Draper and Schlaestett on "General Principles of Instrument Analysis" and is particularly useful for the design of simple instruments of the "engine indicator" type;

2. "Automatic Control in the Process Industries" by Mason and Philbrick of The Foxboro Co., which gives a mathematical treatment of a complete controlled system, useful to anyone working in this field; and

3. "Thermostatic Bimetals" by Eskin and Fritze which has an interesting treatment of the hysteresis due to the "two-phase" nature of invar.

The first paper was sponsored by the Machine Design group and the others by the Committee on Industrial Instruments and Regulators which also had an interesting report by a subgroup on terminology.

ED S. SMITH, JR., Chairman
Committee on Industrial Instruments and Regulators

And so it goes! Let philosophers and economists figure out recondite primary causes. As for us, we see straws in the wind; and the beneficial wind is a growing instrument-mindedness among Americans who work productively, think logically and act constructively. —M. F. BEHAR, *Editor*

THE MONTH'S NEW INSTRUMENTS

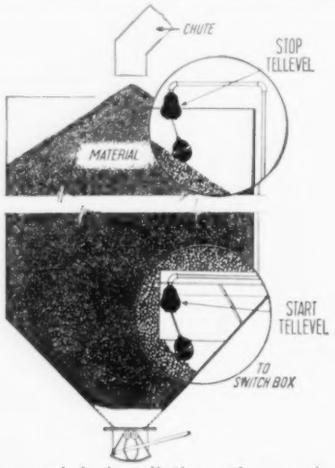
In this department we strive to report each month ALL the new devices for measurement, inspection, testing, metering and automatic control—in the form of concise technical descriptions.

When writing to manufacturers directly, please mention this department as your source of information.

Or write to Information Section, Instruments Publishing Company.

Liquid or Granular Material Level Control Switch

"Tellevel Automatic Storage Control" is a dust-tight explosion-proof multiple-electrode mercury switch so mounted that tipping it breaks the circuit. Illustration shows



recommended installation of a pair of "Tellevels"—one to start conveyor feeding material into bin; the other to stop conveyor when bin is full.—*Stephens-Adamson Mfg. Co., Aurora, Ill.*

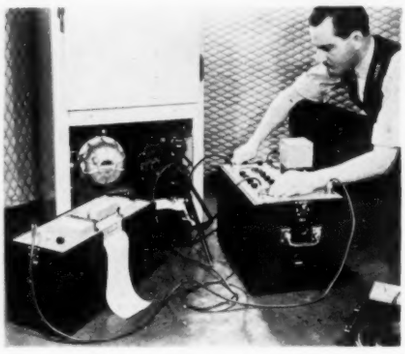
Repeat Cycle Timer

New repeat cycle timer is designed for use on a-c. circuits to (a) alternately close and open one or two circuits continuously at any preset operating interval, (b) close

or open a single circuit after any preset operating interval and stop, ready to repeat upon reclosure of a starting switch. Available in time ranges (different dial scales) from 1 min. to 12 hrs. total. Each dial is equipped with a frictionally-held operating arm adjustable to any desired operating cycle within dial range. Motor, ratings and other features are similar to those of same maker's Cycle Controller described in last month's issue, page 286.—*R. W. Cramer, Inc., Centerbrook, Conn.*

Audio-frequency Spectrum Recorder

Announced as an "industrial stethoscope" for the use of acoustic engineers engaged in diagnosis and checking of running machinery, new Recording Frequency Analyzer achieves frequency analysis by the



sweep method, using a small drive motor to actuate the frequency dial which sweeps the whole range of audible frequencies (from 30 to 10,000 c.p.s.). With this motor is synchronized another motor driving a strip chart on which a stylus traces the sound level at each frequency passed. Sharpness of frequency selection is assured by crystal filters said to be "the finest available."—*Electrical Research Products Inc., 195 Broadway, New York City.*

Test Gage

New Laboratory Test Gage, for checking pressure gages, is announced. Its accuracy is guaranteed to within 0.25% of scale range. Outer edge of dial is a mirror, to

prevent parallax error. Gage has a transparent plastic cover (see *Instruments*, Nov. 1939, page 288.) Case is Phenol.—*Ashcroft American Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.*

Chemical Analysis Recorder Using Heyrovsky Method

Heyrovsky Micro Polarograph is announced for polarographic analysis, a new analytical method based on current-voltage curves and relying principally on the dropping-mercury cathode to provide a completely polarized electrode in conjunction with one which is not polarizable. Applica-

tion of the dropping-mercury cathode is said to have been perfected to a point that, when employed with an adequately specialized measuring system, it offers the following analytically significant characteristics: (1) a completely polarized cathode; (2) a non-polarizable anode; (3) a high hydrogen overvoltage at the cathode; (4) a continuously renewed cathode surface; (5) an automatic, continuous resolution of deposited substance; (6) a minute cathode area, at which diffusion rate can be established as a current limit. Primary functions of Micro Polarograph are (1) to apply to the electrolytic cell at a predetermined uniform rate an accurately known voltage change and (2) to indicate and record precisely the current flowing through the cell at all stages of voltage increment. The resulting polarogram is two-dimensional with applied voltage measured along the abscissa and current or linear galvanometer deflection measured along the ordinate. When a point has been reached equal to the reduction potential of the available ion a rapid acceleration of current begins which, in turn, leads to a deceleration ending in a slope roughly corresponding with that of the initial section. The characteristic form of that part of a polarogram which shows the identity and concentration of the discharging ion is called a current step. The position with respect to the voltage axis at which the sharp acceleration takes place, indicates the reduction potential of that ion under the conditions existing in the electrolyte and with respect to the mercury cathode. This voltage, called the half-wave potential, is a characteristic constant for each ion, independent of the concentration of that ion. Under proper operating conditions, height of step is proportional to the existing concentration of the substance yielding the discharging ion. Limit for qualitative detection and identification in polarographic analysis is of the order of 0.01 gamma of mass, or one hundred-millionth of a gram. For quantitative measurement, maximum convenient dilution is about 10^{-5} to 10^{-6} N.—*E. H. Sargent & Co., 155 East Superior St., Chicago, Ill.*

BAILEY METER CONTROL SYSTEM

The Mark of

Effective Control

Process Control for sensitive, stable automatic control of temperature, pressure, liquid level, flow and other factors as applied to industrial processes. Responds to changes quickly, without overtravel or hunting. Ask for Bulletin No. 101.

Combustion Control that is simple but *complete* for providing economical operation of boilers of 200 h. p. and larger. Details in Bulletin No. 102.

Recorder-Controller

Boiler Meters for recording combustion conditions and guiding boiler operators. Described in Bulletin No. 44.

Multi-Pointer Gages for indicating factors such as draft, pressure, temperature and speed. These Gages are available with any number of pointers and any scale combination; in either the oil sealed bell or diaphragm construction.

Control Drive

Flow Meters for indicating, recording and integrating the flow of steam, water, sewage, air, gas and other fluids. Bulletins No. 39 and 300.

Recorders for pressure, temperature, drafts, liquid level and other factors.

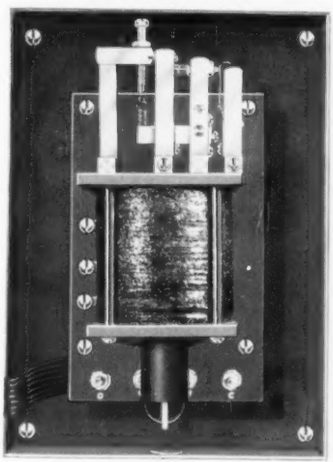
G-3

BAILEY METER COMPANY

1041 Ivanhoe Rd., Cleveland, Ohio

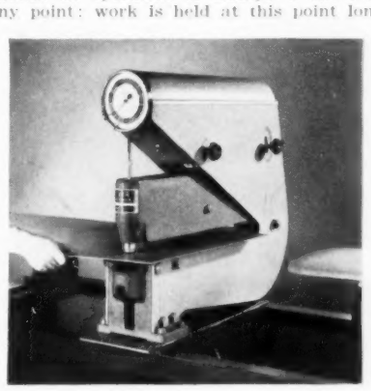
Automatic Voltage Regulator

New "GB-1" voltage regulator is for small alternators of the separately-excited type whose exciter field currents do not exceed 1 amp. at maximum load on alternator. Operation: Alternator voltage is imposed across the regulator coil (and series voltage dropping resistor which decreases voltage error due to frequency changes). Current through coil acts to pull floating iron core upward, opening contacts. When closed, contacts short out exciter field rheostat; when open, they allow full resistance in exciter field circuit. When alternator voltage is normal, contacts are in a position to alternately cut exciter field rheostat into and out of the circuit, the a-c. voltage being determined by average resistance, or ratio of time contacts are closed to time they are opened. Contacts open and close 120 times per second. Regulator response to a given load change is, therefore, ½ cycle, or 1/120 second. Stationary contact is mounted on a light leaf spring, which absorbs rapid vibration of moving contact and eliminates "clinging" or "bouncing." Adjustments: of a-c. voltage, by an adjusting screw; of sensitivity and stability, by tension screw at base of stationary contact post (this adjustment is extremely sensitive).—*Burlington Instrument Corp., Burlington, Iowa.*



Sheet-gaging Micrometer

"Guyer Gauger" is a mechanical micrometer for rapidly checking thickness of metal sheets. In operation it clamps a sheet at any point; work is held at this point long enough for operator to read the dial; it is then automatically released for removal from machine or to next point to be measured. Cycle of clamping, gaging and releasing is oconstantly repeated. Cycle frequency is under control of operator. Standard machine will indicate from 8 to 38 gage reading per minute; others can be supplied. Throat of machine is 23" deep clear of measuring anvil. Dial is graduated in 0.001" increments.—*Streeter-Amet Co., 4101 Ravenswood Ave., Chicago, Ill.*



New

PUSH-PULL ELECTRONIC VOLTMETER-OHMMETER

.05-5000 Volts DC in 9 Ranges!
.01 Ohm-1000 Megohms in 7 Ranges!

IT'S THE *Rider Volt Ohmyst!*

HERE'S a laboratory instrument with ranges so wide it will not only take care of today's engineering requirements—but tomorrow's as well.

It's the Rider Volt Ohmyst and with it you can measure DC voltages in high resistance photo-cell circuits, television circuits, bias cells, operating voltages across tuned circuits with the signal present—with surprising speed and accuracy. This instrument covers the actual operating voltage. No circuit loading. Its input resistance of 160,000,000 ohms on all ranges between 500 volts and 5000 volts makes the Rider Volt-Ohmyst a universal instrument—one that has minimized obsolescence. Get full details and specifications from your RCA Test Equipment Distributor—or write to the address below.

The Rider Volt Ohmyst is Stock No. 163—**net price $57.50.**

Over 335 million RCA radio tubes have been purchased by radio users . . . in tubes, as in Parts and Test Equipment, it pays to go RCA All the Way.

RCA *Test Equipment*

RCA Manufacturing Co., Inc., Camden, N. J.
A Service of the Radio Corporation of America

Street Lighting Evaluator

New "G-E Street Lighting Evaluator" serves as a traveling laboratory enabling safety authorities to quickly, conveniently, and accurately evaluate the effectiveness of

street lighting systems. It comprises three essential parts. One, mounted on hood of automobile and extending beyond radiator, is a miniature strip of street, with pavement similar in tone and texture to surface of roadway under study. On it are typical obstacles. Its position above headlamps of approaching cars makes it possible for investigator to proceed with an appraisal at any time without waiting until traffic has disappeared. Part resembling a loud speaker above windshield is a glare collector which measures total glare from all street lamps, within driver's field of view, and loss of vision resulting therefrom. On driver's seat is operator's control box provided with dials and selector switches. It automatically records on a card the measurements of the three factors (brightness of pavement, objects, and interference with seeing caused by glare from the system). Only a few moments are said to be required for operator to compute the net visibility at a given location.—*General Electric Co., Lamp Dep't, Nela Park, Cleveland, Ohio.*

Tube Tester

New "Model 311P" tube tester occupies bench or counter space 10"x15" and is 7" high, overall. Controls are mounted on sloping panel. 4¾" scale is calibrated in four

multi-colored ranges. Test circuits are in accord with latest RMA standards with 25-watt line control and special 6H6 circuit to insure accuracy. Test features include provision for "hot" interelement short and leakage tests; checks of cold-cathode rectifiers; testing individual sections and elements of multi-purpose tubes, duo-diodes and full-wave rectifiers; full floating filament tests with any voltage available at any two prongs of all sockets, etc. Direct-reading ohmmeter (power supply self-contained) provides ranges of 0-10,000 and 0-1 megohm. Direct-reading capacity ranges

Measure SPEED

with split-second accuracy

The *"Jagabi" Hand Tachoscope* gives you the exact number of revolutions in the exact time in which they were made. An automatically combined speed counter and stop-watch, for all speeds up to 20,000 rpm.

Send for Bulletin 1505-I.

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20 WEST 47th ST., NEW YORK

are 0.001-0.4 and 0.4-16 mfd. Neon indicator provides condenser leakage tests. Also available (Model 311P) as a combination portable and counter unit.—*Radio City Products Co., 88 Park Place, New York City.*

Multiple Service Instrument

New "Model 801" combines functions of a tube tester, set tester and "multi-meter." With its power supply, it is built into a carrying case 12" × 12½" × 6". It has a d'Arsonval movement with "Alnico" magnet

and multiple scales in three colors. Accuracy is 2%, voltage sensitivity 1000 ohms-per-volt. A-c. voltages are read on linear scales. All old and new tubes can be tested at standard RMA voltages and loads and with filament or heater voltages available up to the full line value. Line voltage is controllable from 103 to 135 volts and provision is made for "hot" interelement short and leakage tests, testing individual sections of multi-purpose tubes, noise tests, etc. Ranges: D-c. voltmeter, 0-10/50/500/-1000; a-c. voltmeter, 0-10/50/500/1000; d-c. milliammeter, 0-1/10/100/1000; d-c. ammeter, 0-10; ohmmeter, 0-500/5000/1 meg./10 megs.; db meter, —8 to + 15/15-29/29-49/32-55; output, same as a-c. volts. Tester is available in two types, for 115-v. a-c., and for 220 v. a-c. lines.—*Radio City Products Co., Inc., 88 Park Place, New York City.*

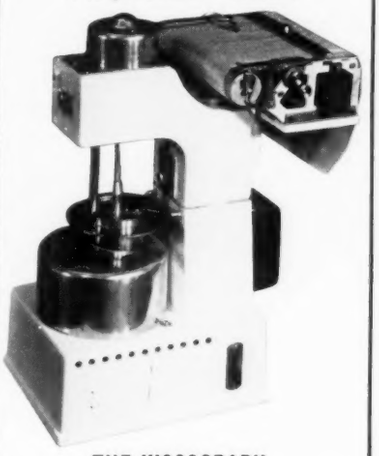
Portable Drawing Table

"Handy" portable folding drawing table does not shake when in use, sets almost automatically to the right drawing position, has a pencil and instrument rack

across the top, folds to 3" thick. The 20" × 26" pine drawing board is permanently attached to a hardwood supporting frame.—*Eugene Dietzgen Co., 2425 Sheffield Ave., Chicago, Ill.*

RECORDING VISCOSITY

With Automatic Constant Speed Temperature Increase



THE VISCOGRAPH

Recording Viscosimeter, with the following novel features:

1—Automatic constant speed temperature increase—from room temperature to 150° C.

2—Constant temperature, adjustable to any point within the above range.

The Viscosity is recorded continuously by means of a curve.

The VISCOGRAPH has been applied successfully in the testing of:

Oil	Glue	Artificial Silk
Printing Ink	Detrin	Starch
Latex		Flour, etc.

BRABENDER CORPORATION
ROCHELLE PARK, N. J.

RUBICON PORTABLE PRECISION POTENTIOMETER

Available in a number of double range combinations, such as 1 volt and .1 volt, 100 MV and 10 MV, also in pH ranges. Guaranteed accuracy .1%. *An outstanding value.*

Described in Bulletin 270 which also describes *Rubicon* High Precision Type B Laboratory Potentiometer.

We also make galvanometers, electrometers, colorimeters, permeameters, Wheatstone and Kelvin Bridges, Resistance standards, coil testers, acronographs, clip-on transformer ammeters.

Descriptive bulletins available on request.

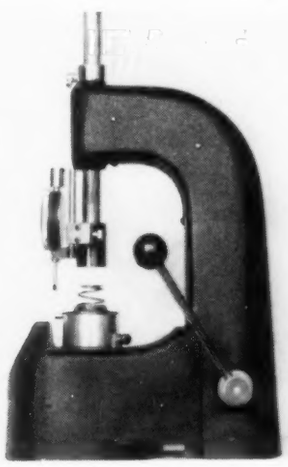
RUBICON COMPANY
Electrical Instrument Makers
29 North 6th Street Philadelphia, Pa.

Tube and Battery Tester

New "Model 777" Tube and Battery Tester is said to be the first tube checker permitting battery tests under the correct load, so that if battery shows "good" on instrument scale, it will be capable of delivering sufficient potential to receiver when loaded with all of tubes. Condition of battery is indicated on a "good-replace" scale. Current drain on battery is also adjusted to conform to requirements of set. Model 777 tester is available both in counter and portable types, the former having a new roller index system, also noise test and complete inter-electrode short check. Battery test and tube test measurements are made on separate scales.—*Weston Electrical Instrument Corp., 591 Frelinghuusen Ave., Newark, N. J.*

Spring Checker

Available in 10-, 50- and 250-lb. capacity units, new "Model PB3 STD" is furnished standard with a 6" vertical height scale graduated to 1/32" for indication of compressed height. Shown here equipped with a special 1" travel reverse-reading dial indicator fitted in an adjustable ram bracket to allow maximum range of 4". For quantity work there is available the "Height-rol," an electrical contact circuit giving a buzzer signal when pre-set height stylus makes contact. For checking small tension springs, a bridge may be fitted to the table. Typical applications include checking springs for load at one or more compressed heights; testing fixture where load reading of pressure or compression is required; testing rack-and-pinion assemblies and assembly of firing pin mechanisms are examples. Accuracy is said to be well within ASTM standards for this classification of testing equipment. Units are equipped with precision ball bearing throughout. Height of machine, 19"; base 8"x14"; weight approx. 50 lbs.—*Link Engineering & Mfg. Co., 1054 W. Baltimore Ave., Detroit, Mich.*



How

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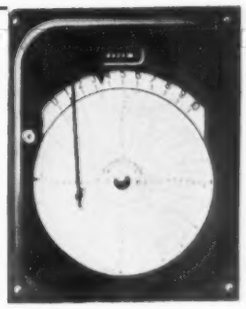

Cochrane Flow Meters at the Sloane-Blabon Corp. of Philadelphia, have fully justified the title of "Cash Register of the Coal Pile."

Cochrane Electric Flow Meters are used as one means of checking the efficiencies of various types of coal and have enabled Sloane-Blabon to select a coal that has resulted in an annual steam cost of only 16.73 cents per 1,000 lbs., including handling to the stoker hopper. The two bottom meters measure steam output from two 50,000 lbs./hr. boilers and the top meter measures the pressure of steam and pressure and temperature of the feed water.

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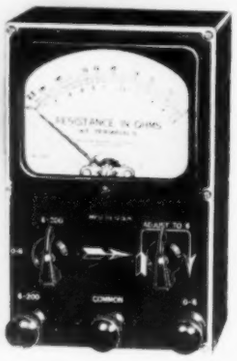
MICHIGAN CITY, INDIANA, U.S.A.

Ultra-low-range Ohmmeter

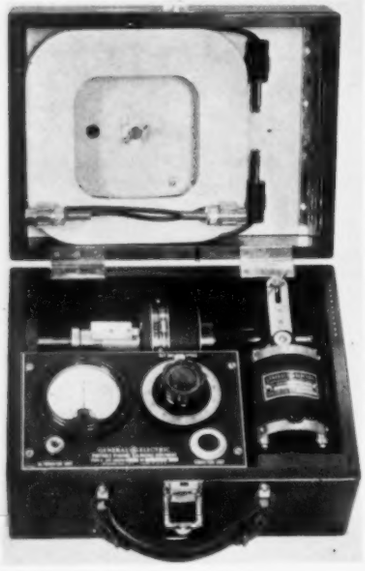
New "Model 4975-S Ultra-low-range Ohmmeter has a 3¾" long scale said to give highly accurate measurements at low values of resistance on two ranges, 0-6 and 6-600



ohms, because of the non-overlapping of the two ranges, thus permitting battery adjustment at the logarithmic center of the accurate section of the scale. Overall accuracy is approx. ± 1° of scale deflection, the scale extending over 100°. Instrument is self-contained, utilizing three easily replaceable flashlight cells, connected in parallel to prevent frequent replacement. Change in battery voltage does not affect accuracy. Special low-resistance leads of No. 8 stranded, rubber-insulated wire have large surface clips at each end.—*The Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio.*

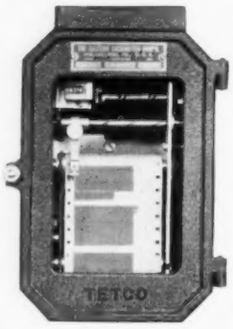
Portable Dynamic Balancing Equipment

New portable dynamic balancing equipment, for use wherever rotating masses require balancing to eliminate vibration, is capable of measuring amount and phase angle of unbalance vibration present in bearing pedestals of a rotating machine running in its own or substitute bearings at any speed between about 600 and 5000 r.p.m. The balance being made under operating conditions, changes effected by load and by the foundations are included. Trial runs required in balancing auxiliary equipment in central stations and manufacturing plants are reduced to a minimum of three. Complete equipment, packed in a single case with no batteries or external power source required, consists of a sine-wave alternator, a vibration pickup, and an instrument with its associated circuit on which mils displacement of the vibration are read. Sine wave alternator spindle is inserted in lathe center hole in either end of rotor of machine to be balanced; vibration pickup is placed against rotor bearing. Determination is made with the machine in its original condition and also with two trial weights attached. Then, from these measurements, calculations are made on a form sheet to determine final weights and their location to be applied to correct original unbalance.—*General Electric Co., Schenectady, N. Y.*



TETCO

Speed Recorder



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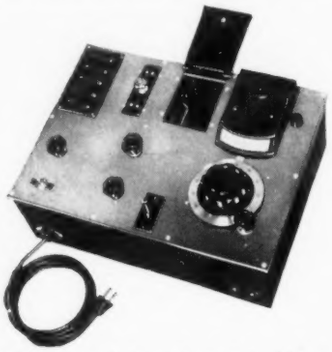
Photoelectric Colorimeter

New "Lumetron Colorimeter" has been designed for greatest possible flexibility and for obtaining results reproducible within narrowest possible limits. Its construction allows use of a great variety of sample holders and light filters, including monochromatic filters. Applications range from simple measurements of light transmission



of liquids to colorimetric and turbidimetric chemical analysis and to abridged spectrophotometric determinations. Special provisions have been made for accurate measurement of extremely dark and extremely transparent liquids, it is said. Instrument uses two blocking-layer photocells in a balanced circuit, operates from power line without constant-voltage transformers. Line voltage changes do not affect readings. Four standard models: (1) For general purposes, a self-contained unit with built-in pointer galvanometer, suited for broad-band color filters and for 1" plane parallel sample holders or test tubes or microcells. (2) For abridged spectrophotometric analysis, equipped with an especially powerful light source and a highly sensitive mirror galvanometer to allow use of monochromatic filters which are inherently dark. (3) To accommodate sample holders up to 6" long for accurate measurement of almost colorless liquids. (4) Combining monochromatic feature and long sample holder. Light from a concentrated-filament bulb is condensed to form a parallel beam which passes at right angles through the plane parallel sample holder so as to avoid errors due to differences in refraction of liquids. Holder for standard 2" × 2" filters is so arranged that the same filter serves both photocells. Intensity of the lamp can be controlled; also, by operating a key switch, circuit is changed so that intensity of light incident on cell is read on galvanometer; thus it is possible to allow not only for changes in light output of lamp but also for light absorption of filter used in each case. In order to obtain linear response, cells are connected in a zero-potential circuit. To reduce influence of thermal effects on photocells, models having powerful lamps are provided with forced-draft ventilation. For protection against overload, galvanometer is equipped with a protective resistor; when instrument is near balance, resistor is cut out by key switch and full sensitivity of galvanometer is used for final adjustment. Another protective feature: lamp turned off automatically when filter holder is removed. Special models can be furnished with built-in range switches to spread dial readings over any desired limited transmission range.—*Dr. F. Loewenberg, 10 East 40th St., New York City.*

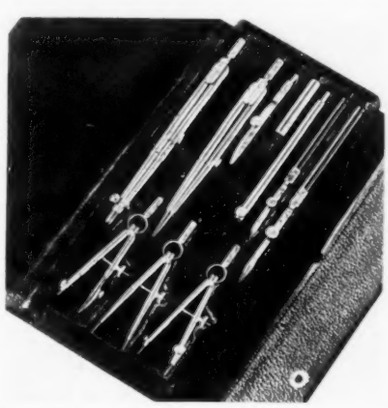
Radio Compass for Yachts and Coastwise Craft

New "50A" radio compass unit is said to give yachtsmen and others operating coastwise vessels a precision navigating instrument, is designed to operate in con-

junction with maker's marine radio telephones, covers frequencies between 230 and 350 kc. which include U. S. Lighthouse Service and Civil Aeronautics Authority radio beacons. It consists essentially of a specially shielded loop antenna, mounted on a tuned r-f. amplifier, and a frequency converter. It derives all power from the radio telephone equipment with which it is used. It measures 10" wide, 7½" deep, 22¼" high including loop, and weighs approx. 17 lbs. —*Western Electric Co., 195 Broadway, New York City.*

Drawing Instruments

American-made drawing instruments developed for straight-line production and called "Minusa" (contraction of "Made in U. S. A.") have a slender "rounded taper"



construction, designed to produce balance and maximum strength. Except for the hand fitting of all moving parts, Minusa instruments are made by modern machine production methods said to improve on hand operations.—*Keuffel & Esser Co., Hoboken, N. J.*

A practical Noise Instrument for *Routine Production Testing* in your plant

Industrial Noise Analyzer RA-273

- Simplified controls
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- Feedback stabilized amplifier
- A. S. A. standard sound meter
- Used with moving coil microphone or vibration unit

FOR THE PLANT—Large number of filter combinations permits segregation of different noises characteristic of specific defects in assembly. Simple controls adaptable to production line conditions. Rugged design insures calibration stability and reliability.

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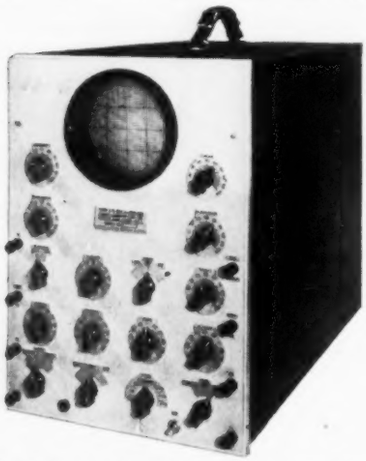
Laboratory C-r Oscillographs

Recent advances in cathode-ray oscillography are said to be incorporated in new "Type 175" for study of high- and low-frequency recurrent phenomena, and "Type



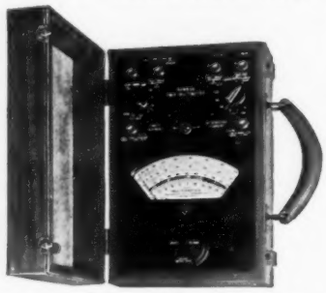
175-A" in which control circuits have been added to the saw-tooth oscillator, permitting single-sweep control of the horizontal deflection. Both employ "Type 54-11-T" 5" intensifier-type c-r. tube fully described in March 1939 *Instruments*, page 76. High-grain wide-frequency-range amplifiers for both horizontal and vertical axes, permit instrument to be used directly from output of vibration pickup units or with proper microphone, have response uniform within better than 10% from 5 to 100,000 sinusoidal cycles per second. To facilitate study of phase relationships, horizontal and vertical amplifiers are identical so that any phase delay thereby introduced is identical in both axes. Push-pull deflection-amplifier stages, provide symmetric deflection of c-r. tube, obviate spot defocusing at extreme edges of screen. A new feedback circuit for supplying signal to grid of second tube of push-pull deflection stage of each amplifier is so arranged that pattern shifts due to short-time power-supply voltage fluctuations are balanced out and pattern remains steady on screen. Sweep circuit provides essentially linear horizontal deflection as a function of time, reads time from left to right, is continuously variable over a repetition rate from 15 to >30,000 times per second. In "175-A", there is also included a sweep circuit so controlled that beam remains at one side of screen until initiating impulse is received, at which time the beam makes only one complete linear sweep.—*Allen B. DuMont Labs., Inc., 2 Main Ave., Passaic, N. J.*

Delayed-action Mercury Switch

New "Kon-nec-tor" mercury switch units are announced, in which mercury is caused

to flow through orifice, thereby causing predetermined delay. Sizes, etc., correspond to "Kon-nec-tor" line; delay intervals from 0.5 sec. to 10 sec., for circuit-closing or -opening.—*General Electric Co., Schenectady, N. Y.*

Rawson Twin Multimeter



29 ranges in less space than any near equivalent combination—size 12" x 8" x 6"

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60 millivolts to 1000 volts

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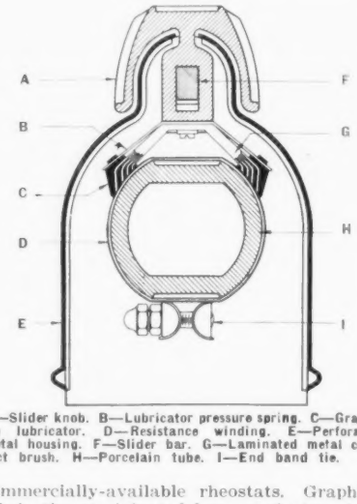
Rheostats With Lubricated Individually-fitted Brushes

An entirely new line of sliding-contact rheostats, for plant and laboratory applications, is said to incorporate a number of improved features never found before in

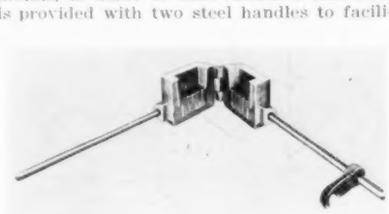


A—Slider knob. B—Lubricator pressure spring. C—Graphite lubricator. D—Resistance winding. E—Perforated metal housing. F—Slider bar. G—Laminated metal contact brush. H—Porcelain tube. I—End band tie.

commercially-available rheostats. Graphite lubrication (originated by manufacturer) is accomplished by a pair of graphite blocks, each held in the path of the brush by a separate spring. This not only eliminates wear and gives easy action but prevents fusing of sliding member to winding—a trouble often caused by overloading. Each brush has eight separate contacts, is of laminated spring-tempered phosphor bronze, ground by hand and fitted to each rheostat. Brushes have a small and constant intermediate resistance; with minimal load of each of the eight segments to assure retention of resiliency after heavy overloading. Winding is a Cu-Ni alloy with negligibly small temperature coefficient of ohmic resistance; its form is close-wound oxidized wire, or space-wound ribbon, depending on current capacity. Porcelain tube is glazed inside and out. It has two longitudinal recesses, bridged by the windings, whereby windings dissipate heat faster than they would on a plain cylinder, and are also held more tightly in position—two characteristics useful in case of overloads. Slide bar is not only extremely rigid but is prevented from turning by means of ceramic bushings. More than 100 sizes and ratings are available in the conventional (open) form; also more than 100 with complete protection, as illustrated, which makes it impossible for use to touch either a "live" or a heated part.—*Rex Rheostat Co., 37 West 20th St., New York City.*

Cast Metal Specimen Mold

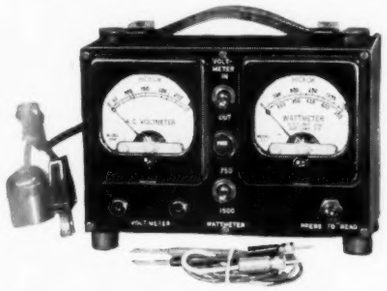
New cast metal mold, used to form test specimens of either non-ferrous or ferrous metals, is made of heat-resistant cast iron, is provided with two steel handles to facili-



tate operation. Metal poured into pouring basin forms four test specimens $\frac{1}{8}$" diam. × 1" long. Two of these may be used for spectroscopic analysis and the other two broken into $\frac{1}{4}$" pieces and weighed for carbon or sulphur determinations. Specimens may be made ready for the laboratory in less than a minute.—*Harry W. Dietert Co., 9330 Roselawn Ave., Detroit, Mich.*

A-c. & D-c. Appliance Testing Volt-wattmeter

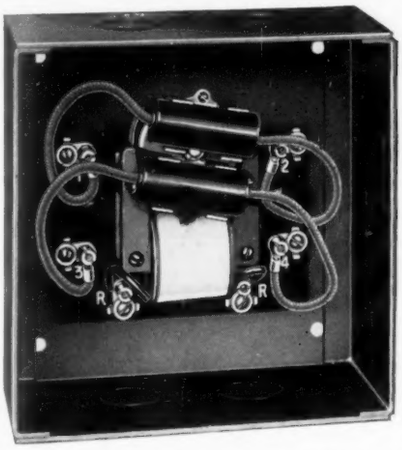
New "Model 145" dual-instrument tester checks line voltage while measuring consumption in watts in appliances. Voltage drop through house wires is checked by not-



ing drop in voltmeter reading when appliance is plugged in. Checks starting coils in fractional h-p. single-phase motors. Watts are indicated on two ranges—0-750 and 0-1500. Wattmeter has electrodynamometer movement and a uniform scale—an exclusive feature. Voltmeter range 0-300 with red line at 110 and 220, magnetic vane movement gives practically uniform scale. Both instruments have 2 1/2" scale length. Two sets of leads are supplied. Toggle switch connects voltmeter direct to separate test jacks. Fuse protects all volt circuits. Instruments may be continuously connected to circuit under test. Special carrying case has lead compartments.—*The Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio.*

High-speed Relay

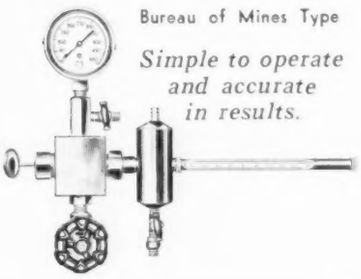
New "M-39" relay is said to be the only rotating type of relay employing a tilting mercury switch, designed for high-speed operation. Magnetic brake damps movement



of switch, making it "dead beat." Mercury switch, attached to a rotating disk on armature shaft of magnetic element, is unbreakable. Its refractory breaker shields metal parts from arc, retains a pool of mercury in cap end so that there always is a positive mercury-to-mercury contact, and serves as a "dam" over which mercury separates, thus locating the arc, which is de-ionized and completely shielded. Relay is furnished in two styles: with a single mercury switch and with two switches. Switches are furnished for make or break, or for make-break combinations. At 115 volts a.c. each switch has a breaking capacity of 15 amps. Operating coils from 6 to 250 volts a.c. or d.c. are available and have a current consumption of approx. 5 watts. Mechanism is mounted on a Bakelite panel 3" high and 3 1/4" wide. It is regularly furnished in a metal cabinet 6" × 6" × 3".—*The Autocall Company, 30 Mack Ave., Shelby, Ohio.*

DEW POINT TESTER
FOR HIGH PRESSURE GASES

Bureau of Mines Type



Simple to operate and accurate in results.

This apparatus for the accurate determination of the dew point of gases under pressure was developed by the Bureau of Mines and is described in its Report of Investigations 3399.

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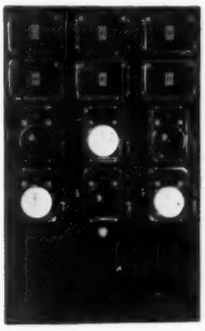

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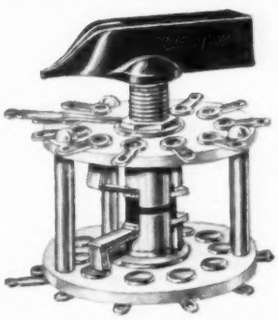
SHALLCROSS SOLID SILVER SWITCHES



Ideal for Thermal Couple Selector Switches. Furnished unmounted or mounted in boxes.

Superior solid silver switches—No. 536—single section and No. 537—two section—1 to 11 contacts of fine solid silver and multi-leaf silver contactarms. Utilizing Ceramic switch plates with high surface leakage; designed to withstand high voltage or maintain extremely low contact resistance. Write today for complete information in Bulletin No. 500 HM.

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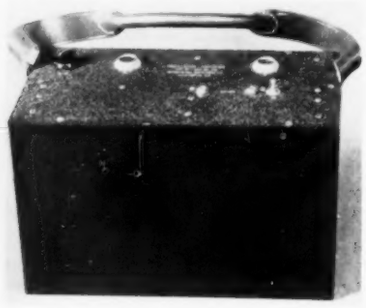
Electrical Measuring Instruments and Accurate Resistors
COLLINGDALE, PA.

Oscillator-Amplifier

Primarily designed for geophysical work, but suitable also for buried-metal detection, new "No. 160" weighs 20 lbs., measures 13" × 6.4" × 8.3", combines a v-t



oscillator and a high-gain (adj. to 100,000) amplifier, is regularly available with factory-set audio or radio frequency, also available (special) with limited adjustable frequency range. "A" and "B" dry batteries are included and provision is made for connecting external storage battery.—*Geophysical Instrument Co., 1315 Half St., S. E., Washington, D. C.*

500- and 1000-Watt Resistors

Maker's line of heavy-duty vitreous-enameled resistors has been extended by addition of 500-watt (illustrated) and 1000-

watt units, now numbers more than fifty sizes. Larger units are available also in "Corrib" type with corrugated ribbon winding.—*Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago, Ill.*

Servicing Instruments for Motor-starting Capacitors

New "Test-Mike" is a multiple-capacitor unit of a-c. electrolytic type, with six toggle switches which in different position combinations provide twelve capacity values

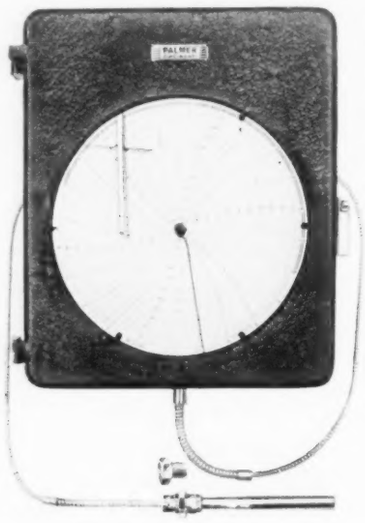
ranging from 18.75 to 150 mfd. It includes a pilot lamp for checking operation of the mechanism which cuts out the starting capacitor when running speed has been reached. Case dimensions 3½" × 5" × 3". New "Service-Mike" gains even greater compactness through elimination of case, switches and pilot lamp; has same capacity range as "Test-Mike" but the twelve variations are obtained through different interconnections of its four terminals. It is cylindrical; 1 13/16" diam. and 3⅞" long.—*Cornell-Dubilier Electric Corp., South Plainfield, N. J.*

Hand Aspirated Psychrometer

New "Type HA/2" is an improved model of hand aspirated phychrometer described in April 1936 *Instruments*, page 93. Thermometers are of 10°-110°F. range with 1° graduations. Handle of instrument forms case and when not in use thermometer and mechanism fold up inside handle, resulting in pocket-size instrument, 7½"x1½"x¾"; weight 8¾ oz.—*Julien P. Friez & Sons, Inc., Baltimore St. & Central Ave., Baltimore, Md.*

Recording Thermometers

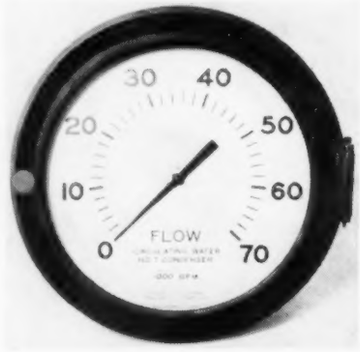
Maker, long specializing in mercury-in-glass industrial thermometers, has brought out a line of mercury-in-steel recording thermometers. Announcement, made after



tests and actual service said to have covered many months, states that "each working part has been designed for maximum strength."—*The Palmer Co., 2511 Norwood Ave., Cincinnati, Norwood, Ohio.*

Round-case Flowmeter

Originally developed for a central power station where available panelboard space limited case diameter to 14½", new round-case model has same internal parts as mak-



er's standard electric flowmeter. Illustration shows flow indicator; also available are recording, integrating and combination models.—*Cochrane Corp., 17th St. below Allegheny Ave., Philadelphia, Pa.*

Actuator for Micro Switches

For use in conjunction with Regular and Metal-Clad Switches, new "Type J" complete roller lever actuator has two mounting holes which register with those of the

Micro Switch. Its lever arm rides on an oilless bronze bearing, which rests on plunger of switch. A case-hardened roller with an oilless bronze bearing is mounted on end of lever arm. Operating ratio is about 8 to 1.—*Micro Switch Corp., Spring St., Freeport, Ill.*

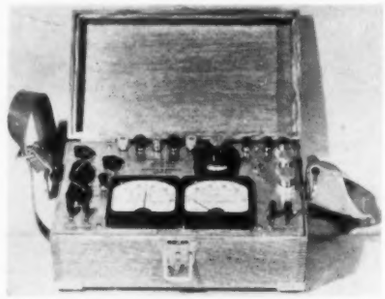
Small Wire-wound Resistors

New and compact "Ohiohmi" ceramic-insulated resistance units, for photoelectric safety and counting devices, motor-starters and relays, etc., are announced. Standard

units are from 5 watts to 20 watts; various resistance values; guaranteed accuracy ±5%. Axial terminal wires replace usual projecting side-lugs. Tough porcelain core has large radiating surface on inside and outside. After winding, the wire, of low resistance-temperature coefficient, is covered with baked-on ceramic coating which resists heat, moisture and vibration.—*The Ohio Carbon Co., 12508 Berea Road, Cleveland, Ohio.*

Resistivity Method Prospecting Apparatus

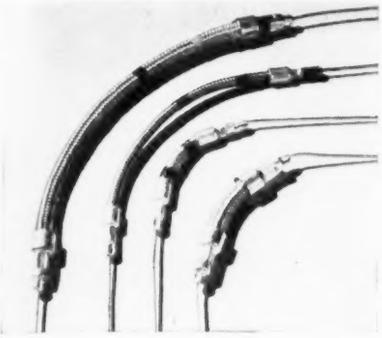
For prospecting and sub-surface investigation by electrical resistivity method, "Type LR" Earth Resistivity Apparatus employs the Wenner four-electrode method.



Currents are read on a 3-range milliammeter, potentials by a mill method. A rugged galvanometer is included but for extreme sensitivity an external galvanometer may be employed. All control and measuring elements are mounted upon a panel which serves also to shield current and potential circuits from each other. Apparatus may be used with maker's Gish-Rooney Commutator for resistivity measurements by means of commutated direct currents (*Instruments*, May 1937, page 128).—*Geophysical Instrument Co., 1315 Half St., S. E., Washington, D. C.*

Fibre-glass Flexible Resistors

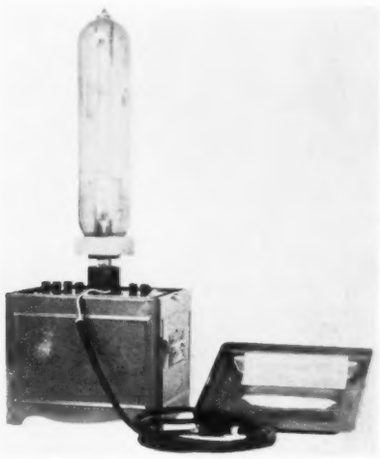
New "Glasohms" make use of 0.0002" diam. fibre-glass filaments as basis for threads of cores and braided coverings, consequently are flexible and may be operated



at temperatures up to 1000°F. without charring, which means a 300% overload at usual ratings. Braided sleeves and metal ferrule ends are colored in accordance with R.M.A. resistance code. Pigtail or other terminals are available. Units are self-supporting, suited to point-to-point wiring, available in two sizes: 1/16" dia. core, rated at 1 watt per body inch and 1/8" dia. core, 2 watts. Resistance values from 1/4 ohm or less to 750 ohms per body inch. Lengths up to 500 feet. Among uses: applications calling for a fixed resistance capable of handling considerable wattage; also as heating elements (since they may be operated at glowing red heat). In use, heating element takes a permanent set in close contact with heated part and casing for maximal thermal conductivity. — *Clarostat Mfg. Co., 285-7 North 6th St., Brooklyn, N. Y.*

Testing Set for Sodium Vapor Lamps

New testing set makes it easier for lighting companies to determine if apparently "burned-out" sodium vapor lamps are actually inoperative. Lamp is merely plugged



in set, which operates from 110 volts, 60 cycles, and normal service circuit turned on. If lamp operates after proper cathode preheating period, fault lies in socket or relay. Set consists of a transformer and operating panel, mounted in a housing designed for easy handling. Panel contains the voltmeter terminals, a lamp socket, transformer adjusting taps, a line switch, and a cathode preheating switch.—*General Electric Co., Schenectady, N. Y.*

Variable Speed Timer

New "112R Precision Set Variable Speed Timer" for vulcanizers, tire presses and platen presses, makes possible exact overall timing of the cure and exact sequence of

the various steps and functions of the cure, hence makes it possible to adjust work load so that individual operator works to greatest efficiency. Seven standard gear ratios provide seven ranges of time adjustment, for each of which there are 80 different speeds of cam revolution. Adjusting the timer from one speed to another is said to be easily and quickly done by hand. Closed mercury switches, eliminating open contacts, are connected to solenoid air pilot valves of the lock-in type so that in case of electrical failure during a cure, the valve will not change position. Done away with are: air pistons, over-running clutches, friction drives and limit switches.—*Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.*

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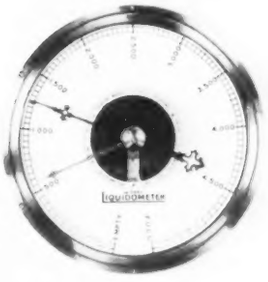

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THE LIQUIDOMETER CORP.
36-27 SKILLMAN AVE. LONG ISLAND CITY, N. Y.

EDITOR'S NOTE—Typical of the air transport industry's tradition-defying spirit is the novel panel mounting of testers, shown on this page. After twice visiting the Cheyenne shops, we suggest that subscribers interested in maintenance apply to United for permission to visit them. Meanwhile, through the kindness of Vice President Harold Crary, we are able to publish this timely article.—MFB

THE FRONT-COVER PHOTOGRAPH shows the dust-proof room received for the overhaul and repair of gyroscopic devices and ultra-sensitive instruments such as altimeters, air speed indicators, etc., in the United Air Lines instrument shop, Cheyenne, Wyoming. The benches in this room were designed and built by United engineers to meet the needs of this particular type of work. On the two benches in the left foreground are motor-driven oscillating plate units designed by United personnel, whereby gyroscopic instruments can be tested in a manner simulating actual flight operation. Several benches are equipped with special manometers for calibrating various types of instruments. In the rear of the room can be seen equipment built for testing manifold pressure gages, barographs, altimeters and flowmeters.

United Air Lines' Instrument Servicing

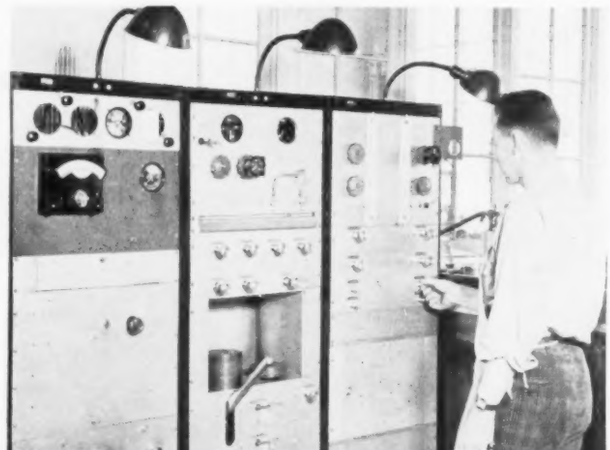
By FRED HUNTER

General Offices, United Air Lines, Chicago, Illinois

FROM the two great 1200-horse-power engines, which had been idling lazily, rose a deep-throated crescendo of irresistible power as the pilot opened his throttles and sent the twelve-ton transport plane flashing across the runway on the take-off of the "Continental" from the New York Airport.

A few moments later the huge plane had found its cruising level and its twin engines were carrying it three miles a minute through the air toward Chicago on the first lap of United Air Lines' overnight sleeper flight to the Pacific Coast.

Within the cabin the passengers made themselves comfortable with the assistance of a stewardess who seemed to anticipate their every want. Presently, the stewardess opened her galley in the forward section of the big sleeper plane and prepared to serve a full-course hot dinner. Up in the control cabin the pilot was preparing to radio his first report to the ground, a report that read something like this:



On these three panels special equipment is mounted for testing tachometers, pressure gages and vacuum gages. For this kind of work, the panel structure has proved superior to a bench or table. Both electrical and mechanical tachometers can be tested. An improved type of dead-weight tester (partly concealed) is conveniently operated from the front of the center panel. It and the manometers make it possible to check accurately pressure-measuring and vacuum-measuring aircraft instruments of any range.

"Smith in 362. Over Allentown range station. 8000 feet. Above overcast, slightly broken, estimated 5000. Speed 192. Compass heading 270. Estimated wind 12 miles an hour northwest. All OK."

When the passengers boarded the plane in New York the weather had been gloomy and unpleasant, but up here, at 8000 feet, the big plane skimmed along at the "sunshine level," where it was calm and clear and smooth. Passengers looking out the windows toward the ground saw only the top of the overcast, which was the "roof," so to speak, of the weather they had just left behind.

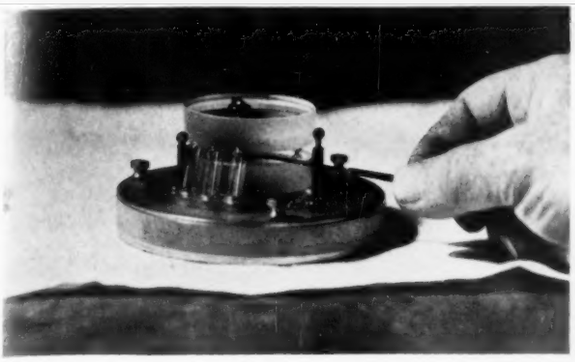
That no landscape markings were visible was a matter of complete unconcern to the two pilots. For the modern transport pilot is an instrument pilot. He has learned to trust his instruments more than his senses—because instruments do not fail and, as everyone knows, the human element occasionally does.

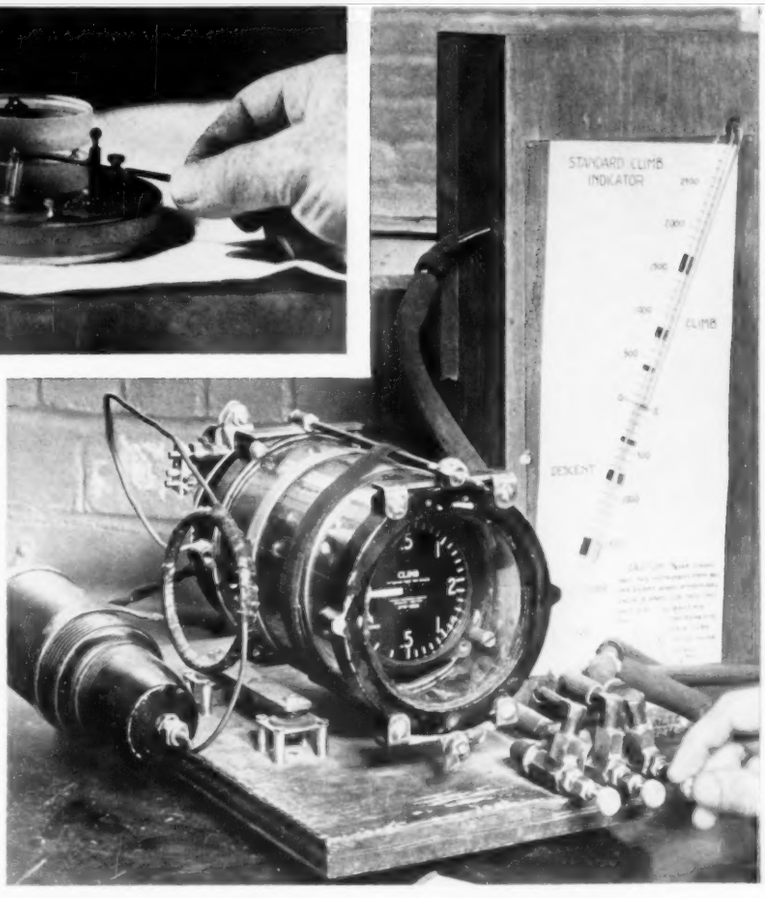
As the twelve-ton craft continued its 192-mile-an-hour flight westward, the pilots held their course perfectly by following their radio directional signals and keeping their eyes on the instrument panel before them. Two altimeters told them how high they were flying, offering visible evidence that they were at least half a mile above the highest terrain in the area over which they were flying. Their artificial horizon told them they were flying directly in the path of flight they had selected. Their inclinimeter told them the progress of their flight in rate of ascent and descent and their bank-and-turn indicator told them exactly how their craft was flying in terms of turn movements. And nearly a hundred other instruments were indicating or recording the performance of the plane, of its engines and of its accessories, so that during every second the pilots could tell at a glance precisely how the flight was proceeding.

To be sure, there were only two pilots in the cockpit of the big Mainliner slipping through the air so easily and speedily, but actually thirty other men in the instrument overhaul and repair shop out in Cheyenne, Wyoming, were playing as important a part in providing the safe and sure operation that marks transport flying in the United States.

In air transport operation, Accuracy and Dependability are the twin watchwords in the rigid code of instrument procedure. Pilots have come to trust their instruments because they know they are accurate and because they know they will not fail. The accuracy requirements for instruments in air transport operation are considerably greater than those for most other types of flight operation. For this reason it has been necessary for the airlines to set up instrument overhaul and repair shops capable of performing the finest and most accurate work. To do this, much special test equipment had to be developed by the airlines' own engineers; and instrument technicians had to be trained by the airlines themselves for this particular type of work.

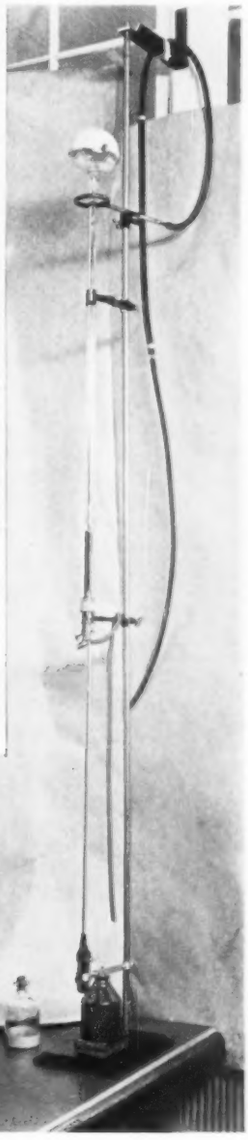
In many instances the accuracy required for instrument equipment by airlines such as United exceeds that of the manufacturer, or of the military services. For instance, the altimeter calibration limit for all elevations between sea level and 6,000 feet is ± 15 feet. When it is considered that the total range of these instruments is 20,000 feet, it readily can be understood that an accuracy of ± 15 feet is an exceedingly close tolerance.





TOP—Special instrument developed by United's instrument shop for grading bearing balls used in gyroscopic instruments by the use of quartz optical flats. It is set up to check uniformity of size and trueness of sphericity—not for measuring diameters. Through its use, steel balls are graded to a few millionths of an inch. Use of these quartz optical flats enables United to assort bearing balls into exquisitely-matched sets so that even at 15,000 r.p.m., gyroscope rotors run perfectly true.

CENTER—One of the individual-instrument agitated pressure chambers designed in United's instrument shop for testing barometric scales and balance on altimeters as well as calibrating rate-of-climb indicators. This test hookup consists of a master rate-of-climb indicator and an agitated pressure chamber. Due to the geographic location of the shop, the altimeter calibration is accomplished here in a manner somewhat different from the usual practice near sea level: At Cheyenne, United starts at the 6,200-foot pressure, proceeds down to sea-level pressure and, finally, up to the upper (lowest-pressure) range.



BELOW—Mercury reclaiming device built by United's instrument shop. The need of pure mercury is steadily increasing for barometers, manometers, etc., some of which are used as shop standards. Therefore, United frequently drains and refills instruments.

Even some new instruments are recalibrated in the overhaul and repair shop before they are placed in service! This is not a reflection upon the manufacturer; and is only mentioned to show how the air transport operator takes infinite pains to have equipment that will satisfy the extremely rigid standards of performance that he has set up for his particular type of operation.

Modern aviation instruments may be classified according to their uses: (*a*) navigation, (*b*) automatic piloting, (*c*) instrument landing, (*d*) automatic instrument landing, (*e*) powerplant control and (*f*) ice warning.* They may also be divided into four principal classes: (1) pressure, (2) electrical, (3) magnetic and (4) gyroscopic. In these four main classes—not counting lesser ones—there are thirty different types. Because of this, United's instrument overhaul and repair shop in Cheyenne represents a highly specialized industry. Although competent to work on any instrument and qualified to handle any problem that comes into the shop, each technician soon becomes a specialist in a certain type of instrument and is assigned to it.

Instrument technicians don't grow on trees and the United instrument shop has found that it must train its own technicians. In charge of the shop is L. D. Bean, who has been with United since 1930.

Foreman Bean came into the Cheyenne instrument shop from the watchmaker's bench. Because they have acquired facility in working with small parts, watchmakers frequently make good instrument mechanics. But watchmaking ability is not enough to make a good instrument mechanic and an experiment in limiting new apprentices to watchmakers did not work out: a number of them failed to show sufficient adaptability to go on into the more intricate work of aircraft instrument repair.

Instrument technicians have to have a knowledge of spring strength, spring travel, linkages and kinematics in general, as well as pressure-measuring theory and equipment, electricity and other technical subjects, as well as the ability to work with small parts, if they are to turn out the character of work required by the air transport lines.

The instrument overhaul and repair shop in Cheyenne is divided into two divisions, one charged with servicing instruments and the other with repair.

Instruments, like engines, are overhauled at regular intervals. Cheyenne is the location of United's central maintenance base and each of the line's 58 twin-engined Mainliners is routed into Cheyenne after each 500 hours of service. On these occasions, the engines are completely dismounted and the airplanes stripped down. Every instrument aboard is removed and goes into the instrument shop for a complete check and overhaul and such repairs as may be necessary.

Continued on page 327

*W. G. Brombacher, What Instruments Do for the Air Transportation Industry, *Instruments*, Vol. 12, Jan. 1939, pages 43-46.

New Method of Testing Accelerometers

By B. W. WOOLARD
National Bureau of Standards, Washington, D. C.

ACCELEROMETERS are ordinarily calibrated by subjecting them to centripetal accelerations on a rotating turntable. This gives no information on the performance of the accelerometer when subjected to accelerations fluctuating from a minimum to a maximum in a period less than about 20 times the natural period of vibration of the sensitive element of the accelerometer.

One way of obtaining some information on the response of the accelerometer under these conditions has been to subject it to an approximately simple harmonic acceleration obtained by a reciprocating motion. When the natural period of the accelerometer and of the imposed acceleration are both relatively high, the requisite apparatus is large and cumbersome. Moreover, test values are not obtained for conditions equivalent to those met in practice, in that the reciprocating apparatus must be brought up to speed so that the response of the accelerometer can be obtained only for a steady condition of oscillating accelerations.

Another method especially suitable for relatively high frequencies has been developed by the National Advisory Committee for Aeronautics[1] in which the instrument, falling freely, is stopped by a deflecting helical spring.

A new method is described by means of which single-component accelerometers can be subjected to practically simple harmonic acceleration which is either continuous or has a duration of a selected part cycle or number of cycles. The frequency and amplitude of acceleration are controllable within reasonably wide limits.

The apparatus was constructed at the request and with the coöperation of the Bureau of Aeronautics of the Navy Department.

DESCRIPTION OF APPARATUS

The turntable apparatus is modified by the addition of a system of two belted pulleys, one fixed to the stationary base of the turntable; the other located at the rim of the turntable and free to rotate about its own axis. The accelerometer is mounted upon a plate connected to the rim pulley by means of a friction clutch.

[1] James A. Hootman. A method for the dynamic calibration of accelerometers. Presented before Virginia Academy of Science, May 6, 1938.

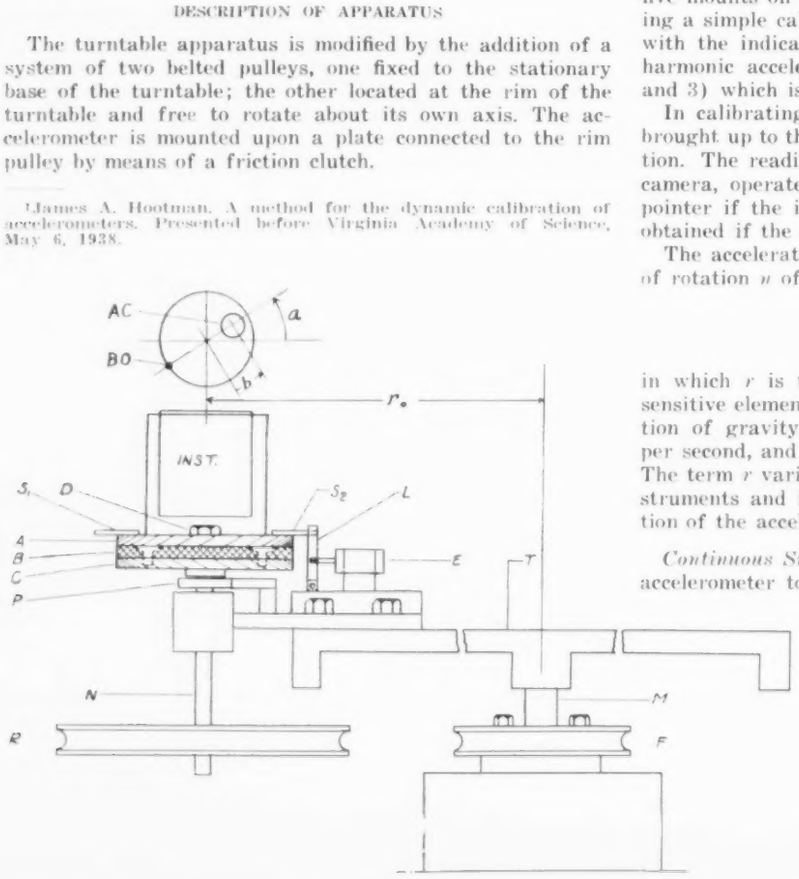


Fig. 1. Diagram of Test Apparatus. T is a motor-driven turntable; F is a stationary pulley; R is the rim pulley; P is a slip ring; plates C and A and brake lining B constitute a friction clutch adjusted by nut D; S_1 and S_2 are metal strips which impinge on stop C; and E is an electromagnet. BO is a reference mark on an accelerometer, the sensitive element of which is indicated by AC.

In Fig. 1, T is a turntable driven through shaft M by a variable-speed motor; F is a fixed pulley bolted to the fixed base of the turntable and concentric with the turntable shaft M; N is a shaft, parallel to shaft M, supported by a housing rigidly attached to the rim of the turntable; R is a pulley and C a flat plate covered with brake lining B, rigidly attached to shaft N; A is a plate upon which the accelerometer is mounted, and which is concentric with but not secured to shaft N. The friction between A and B is adjustable by means of nut D. Pulley R is interchangeable with others having different diameters. It is driven by pulley F by means of a belt.

Plate A is stopped from rotating about its axis by contact of either strip S_1 or S_2 with stop L. Stop L can be pulled out of contact with either S_1 or S_2 by energizing the electro-magnet E by throwing a switch on the control panel. The necessary electric current is brought to turntable T by slip rings on shaft M. Current for operating a buzzer for vibrating the accelerometer under test is conducted to the buzzer through slip ring P.

It is essential that the turntable axis be vertical. Fig. 2 shows the apparatus at the National Bureau of Standards. Turnable T is of cast iron, three feet in diameter. Its rate of rotation is measured by a calibrated tachometer, and is controlled by a variable-speed d-c. motor and (not shown in the figure) a foot-operated brake.

OPERATION

Steady Acceleration. To subject the accelerometer to a constant acceleration it is held in a fixed position relative to the turntable. Ordinarily it is mounted in one of the five mounts on the turntable shown in Fig. 2, when obtaining a simple calibration. When a comparison is to be made with the indication obtained when subjected to the simple harmonic acceleration it is mounted on plate A (Figs. 1 and 3) which is held fixed relative to the turntable.

In calibrating the accelerometer, the turntable is slowly brought up to the speed corresponding to a desired acceleration. The reading of the instrument may be recorded by a camera, operated by a solenoid, by a maximum-indicating pointer if the instrument is so equipped, or by the record obtained if the instrument is a recorder.

The acceleration A in g-units corresponding to the speed of rotation n of the turntable is given by the relation

$$A = \frac{4\pi^2 n^2 r}{g} \qquad (1)$$

in which r is the radius of rotation of the acceleration-sensitive element of the accelerometer and g is the acceleration of gravity. If r is in feet, g is in feet per second per second, and n in revolutions per second, A is in g-units. The term r varies measurably with acceleration in some instruments and in this case must be determined as a function of the acceleration.

Continuous Simple Harmonic Acceleration. To subject an accelerometer to this type of acceleration, plates A and C (Fig. 1) are clamped together, and stop L is held back out of contact with strips S_1 and S_2. A belt connects pulleys R and F.

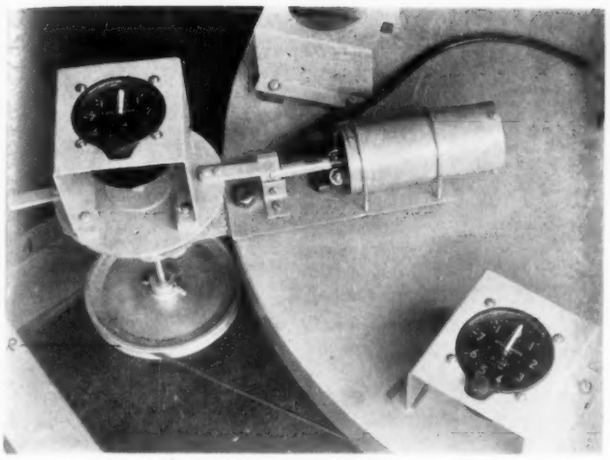


Fig. 2. Accelerometer test equipment at the National Bureau of Standards. R is the rim pulley and A is the plate upon which accelerometer is mounted.

The instrument is mounted so that its center coincides with the axis of rotation of pulley R; or if the motion of the acceleration-sensitive element is small relative to the radius of the turntable, it may be mounted with the center of gravity of the element coincident with the axis.

As the turntable rotates, pulley R and the accelerometer also rotate with respect to the turntable. The acceleration imposed on the instrument is approximately constant in magnitude but varies in direction with respect to the instrument. A single-component accelerometer will be affected only by the component of this acceleration in the direction of the sensitive axis of the instrument. The variation of this component of acceleration will be nearly sinusoidal. The successive positions of the instrument during one revolution are shown diagrammatically in Fig. 3 in which the dot is a reference mark for indicating the orientation of the instrument. Pulleys R and F are shown of equal diameter. At positions (1) and (3) in Fig. 3, the black dot indicates that the imposed centripetal acceleration is at right angles to the direction in which the acceleration-sensitive element is free to move and therefore the active component of the imposed acceleration is zero. In positions (2) and (4) the imposed acceleration is maximal; the imposed accelerations are equal but opposite in sign. At intermediate positions, components of the imposed acceleration actuate the instrument. The active component of the acceleration varies as shown in Fig. 4.

For equal-size pulleys it is evident that the frequency f of the acceleration cycle is equal to the frequency n of the turntable rotation. The frequency is controlled by varying the diameter of pulley R. In this case

$$f = n\,D_s/D_r \qquad (2)$$

where n is the rate of rotation of the turntable, f is the frequency of the simple harmonic acceleration, D_s and D_r are respectively the diameters of pulleys F and R (Fig. 1).

The frequencies obtainable for two accelerations with four pulleys used at the National Bureau of Standards are given in the table below. Frequencies at other accelerations can be computed from equations (1) and (2).

Acceleration g-units	Frequency per Minute — Pulley ratios, D_s/D_r			
	0.60	0.78	1.00	1.82
3	43	55	71	129
6	61	78	100	182

If the accelerometer is of the single-component type (sensitive only to that component of the acceleration of the instrument which is in the direction of the acceleration-sensitive axis, fixed in the instrument) the effective imposed acceleration A in g-units, is given approximately by

$$A = \frac{4\pi^2 n^2}{g} r_a \cos a - \frac{4\pi^2 b}{g} (n - f)^2 \qquad (3)$$

where r_a is the radius of revolution of the center of the case, a is the angle between the acceleration-sensitive axis of the instrument and the radius of the instrument coincident with the radius of the turntable measured as shown in Fig. 1, n is the rate of rotation in r.p.s. of the turntable, g is the acceleration of gravity, f is the frequency of rotation in r.p.s. of pulley R with respect to the turntable as defined in Eq. (2), and b is the displacement of the acceleration-sensitive element from the center of the instrument. The displacement b is measured along the acceleration-sensitive axis and is positive if the acceleration-sensitive element is above the center of the instrument when the instrument is in the normal dial-vertical operating position as indicated in Fig. 1, top view, where AC represents the acceleration-sensitive element and BO marks the bottom of the instrument when it is in the normal dial-vertical position. It is a function of the indication of the instrument at the moment of observation and must be computed or measured for each design of accelerometer.

The last term in Eq. (3) is a correction term for the shift of the acceleration-sensitive element from the center of the instrument. It should be noted that $(n - f)$ is the rotational speed of the instrument about its axis with reference to the room, not with reference to the turntable. When the instrument does not rotate with respect to the turntable, f is zero and the correction term is $4\pi^2 bn^2/g$; when frequency f equals n, the correction term is zero. For a typical maximum-indicating accelerometer the correction was found to be of the order of one or two percent.

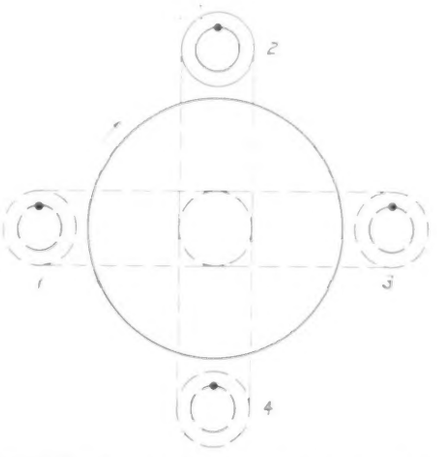
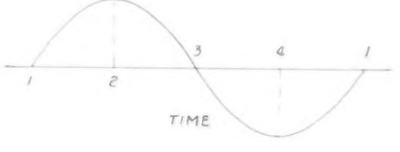


Fig. 3. Arrangement whereby a simple harmonic acceleration is continuously imposed upon accelerometer. Reference dot on instrument shows how the accelerometer rotates about its own axis with respect to the turntable. The effective component of the acceleration is thus varied as shown below.



IMPOSED ACCELERATION

Fig. 4. Resultant variation of effective component of acceleration.

The variation of imposed acceleration will be nearly sinusoidal provided that the accelerometer is a single-component instrument. If the displacement b of the acceleration-sensitive element is not a linear function of the acceleration, there will be deviations from sinusoidal variation of the imposed acceleration. These deviations will be small since they appear as irregularities in the relatively small term containing b in Eq. (3).

Part Cycle of Simple Harmonic Acceleration. To subject a single-component accelerometer to a part cycle or number of cycles of simple harmonic acceleration, the friction clutch

Concluded on page 326

New Applications of Variable-reluctance Method to Aircraft Instruments

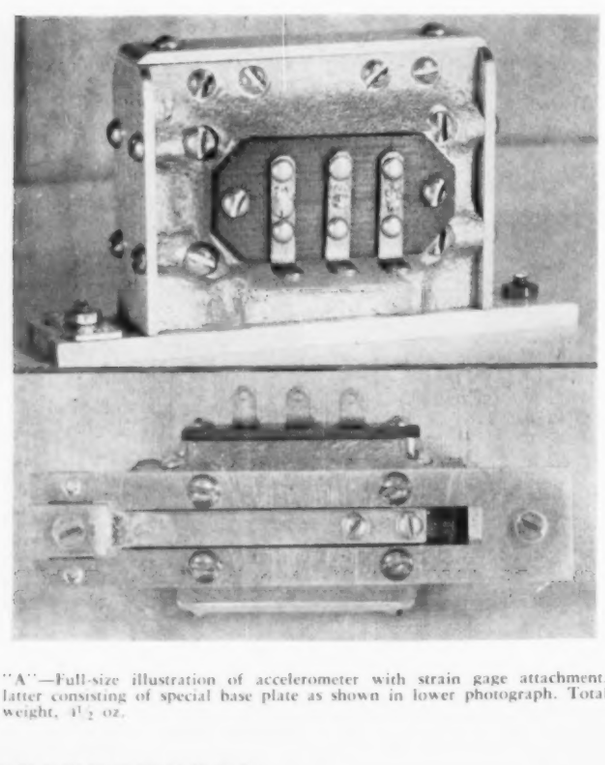
By H. H. BRUDERLIN

Development Engineer, Douglas Aircraft Company, Inc., Santa Monica, Calif.

STRESS measurements in aircraft are of extreme importance to safety, both as they affect design for static loads and as means of determining the effect of vibration and shock loading upon parts of the structure. Some early airplanes, whose strength was based upon estimated requirements alone, did not fare well in service. Landing gear failed frequently, wings and tail surfaces were known to flutter occasionally, and once in a while an engine would release itself from the airplane. Measurements in the field have been found necessary to verify design theory on each new model.

Such investigations require considerable accuracy and must often be made under extremely difficult conditions. Stress and vibration measurements are often needed in the wings, engines, or tail surfaces, where the primary measuring element is remote from the observers. Accurate determinations of combined static and dynamic stress may be required under all conditions of temperature and vibration, where even the order of magnitude is not known before the test flight is begun. The importance of transients and the high cost of operating an airplane impose additional limitations upon the type of equipment that can be used.

No one instrument is flexible enough in its applications to meet satisfactorily all the needs of the test engineer. Four distinct types of primary measuring devices are required, with means for simultaneous recording at a central point so that the records may be studied at leisure. Such pickups all have essentially the same mechanism, consisting of a spring suspending a weight from a mounting base, with means for measuring the movement of the weight with respect to the base. Choice of springs and measuring means fixes the characteristics of the pickups.



"A"—Full-size illustration of accelerometer with strain gage attachment, latter consisting of special base plate as shown in lower photograph. Total weight, 1½ oz.

For determining load factor, or number of times gravity load, applied to a structure during landings, dives, and various maneuvers, an accelerometer is required. This is a spring-controlled device, having a resonant frequency well above its operating range, and a means for indicating the displacement of the suspended mass from its normal position. It may be made to measure both static, or steadily applied gravity factors, and dynamic, or vibrational accelerations. The crystal vibration pickup is a common example of electric accelerometer, although not suitable for measuring sustained load factors.

The output of an accelerometer when used as a vibration pickup is $E = K a f^2$, where a is amplitude and f is frequency. In many applications this characteristic serves

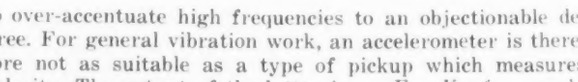


Fig. 1. Basic accelerometer circuit.

to over-accentuate high frequencies to an objectionable degree. For general vibration work, an accelerometer is therefore not as suitable as a type of pickup which measures velocity. The output of the latter is $E = K a f$, making it more useful for wide range testing. Velocity pickups are generally constructed with a magnetic field and a generating coil, one being fixed to the base and the other to the suspended mass, and have a resonant frequency well below their measuring range. The mass, which remains "stationary," serves as a fixed reference point.

For measuring slow vibrations of small amplitude where much high-frequency vibration is present, or for determining the deflection of members under steady load, an instrument having a response independent of frequency is indispensable. This condition, $E = K a$ is, of course, fulfilled when we measure amplitude, or displacement, directly. In the first case, this is done by making the spring flexible enough so that the natural frequency is well below the operating range as in the velocity pickup; the mass remains stationary and its displacement with respect to the base is measured. In the case of sustained deflection this arrangement is obviously not feasible: the base must be fixed to a reference point and the mass to a point at which the displacement is to be measured. Such a device is commonly termed a strain gage or extensometer.

Two years ago a situation arose which required a "good" electrical accelerometer: it had to be small, light, extremely sensitive yet with wide range; it had to furnish accurate signals at a considerable distance; and be uninfluenced by extreme climatic conditions. Nothing being commercially available and our need being urgent, we undertook to build our own.

An accelerometer is fundamentally an instrument for indicating rate of change of velocity, which is ordinarily accomplished by measuring in some way the deflection of a small weight suspended on a relatively stiff spring. How-

r, acceleration may change frequently (think of a ball rolling over a series of ridges) and if the rate of reversal of acceleration is the same as the natural frequency of the weight on the spring, resonance occurs and an exaggerated reading results. If the rate of reversal is faster than the natural frequency of the weight on the spring the weight remains stationary and we are no longer measuring acceleration.

The first requirement of an accurate accelerometer, then, is to have the resonant frequency (since any system having mass and elasticity has at least one resonant frequency) more than twice as high as any frequency at which we may expect acceleration to change. For our case, we chose 140 cycles per second as being well out of the operating range.

There is a definite relation between the frequency of a suspended weight and its deflection under any given acceleration. For a frequency of 140 c.p.s. this amounts to approximately 0.0005″ per *g*. To measure accurately to one-tenth load factor obviously required higher sensitivity than obtainable with any method ordinarily used in stress measurement. After considering possible means we settled upon a variable reluctance bridge as the most promising solution.

Our experimental accelerometer and circuit are shown in Fig. 1. A 500-cycle carrier voltage is applied across the bridge, of which the coils form two legs. As the armature approaches one coil it is leaving the other, and the two nonlinear outputs combined result in linear swing of the common return. This output is applied through an a-c. amplifier to an indicating or recording device. Overall dimensions of the pickup were under 1¼″. The coils were bobbin wound on a special core and as installed had an inductance of 1.5 henries. The limit of sensitivity was the accuracy to which we could balance out the 500-cycle carrier wave in the bridge, which depends upon phase shift and distortion occurring in the coils themselves. Much later we found that shorted turns in the coils were responsible for difficulty experienced in balancing.

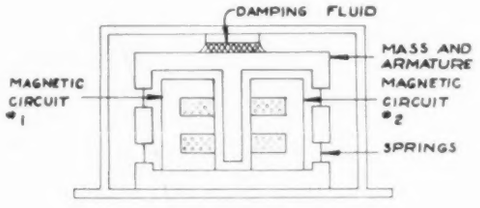
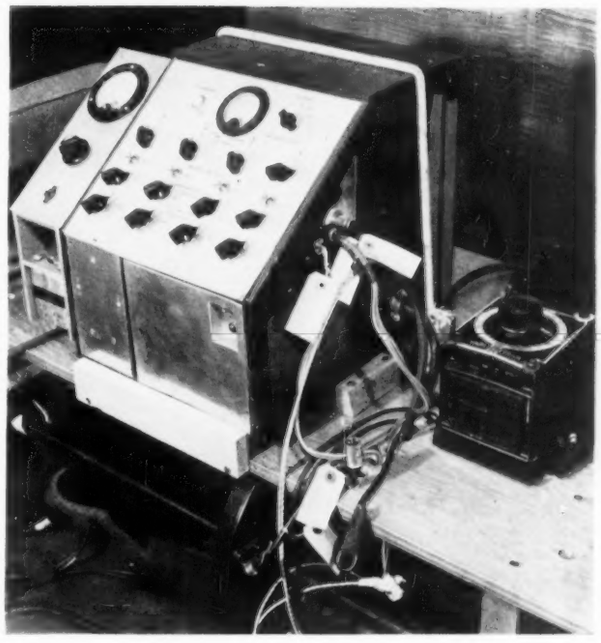


Fig. 2. Present accelerometer.

The present design (Photo "A" and Fig. 2) has been revised for greater sensitivity, range, and reliability. Coils are layer wound and have an installed inductance of 1.2 henries. Four flexure pivots are used, mass, armature and springs being machined from one piece of steel. With about 0.007″ clearance to coil core, sensitivity using present single-tube amplifiers is better than 0.05 *g*. and range is ± 15 *g*. Fluid damping has been added in a novel manner by filling a small clearance between the moving mass and the fixed case with a thick viscous material having an excellent temperature-viscosity characteristic. With approximately 0.7 of critical damping, the output of the instrument is practically linear up to ± 10 load factors at frequencies as high as 90 c.p.s., making it quite useful as a pickup for low-frequency vibration as well as for measuring sustained accelerations. Sensitivity may be varied merely by adjustment of the amplifier gain. The bridge is always operated at such a point that peaks will not cause it to approach a balance too closely.

The variable reluctance principle has for a number of years been used successfully in sensitive strain gages. The new accelerometer was designed in such a way that all that is necessary to make a strain gage of it is to remove it from the case and insert needles at points corresponding to the desired gage length, holes being provided in the frame with ¼″, ½″ and 1″ spacing. With present equipment it can easily measure to an accuracy of 30 lbs./in.² in steel.



"B"—Complete equipment except pickups, for producing four simultaneous records, in the cabin of the DC-4 airplane. The main instrument (with symmetrical control panel) is a combination four-channel amplifier with bridge balancing, gain, and monitoring controls. The narrow unit (at left) is the four-element recorder with film drive, switch, and film speed indicator.

In the presence of vibration the strain gage is made insensitive to accelerations by mounting it according to the principles set forth in the *Bureau of Standards Journal of Research*.[1] Excellent results have recently been obtained by operating the accelerometer bridge directly from a 110-volt 500- to 2000-c.p.s. supply. The rectified output is sufficient, without amplification, to be read directly on an output meter or to actuate a sensitive oscilloscope galvanometer.

After these instruments had been in use for some time it became necessary to measure torsional vibration of an airplane wing at a fairly low frequency. Acceleration measuring devices are not particularly suitable for this purpose because of their characteristic of favoring the high frequencies and because the axis about which we were measuring was so far from the wing itself that it was impossible to get enough differential between two pickups installed at different points to make certain that it was the torsional

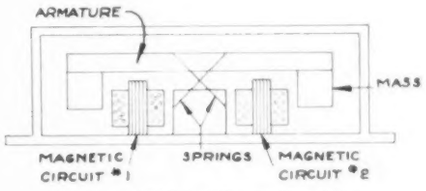


Fig. 3. Torsional displacement pickup.

vibration that was being measured. We therefore devised a similar instrument, still using a balanced inductance bridge, that responded to torsional but not to linear motions. Here again we used flexure pivots. In this case the spring constant was adjusted so that the resonant frequency of the armature was well below any that we desired to measure, giving a torsional displacement measuring device. Being partial to low frequencies, it was thus more suited to our purpose than a torsional accelerometer would have been.

A pickup of this type was also a great deal more difficult to build than a torsional accelerometer would have been.

[1] W. M. Bleakney, Compensation of Strain Gages for Vibration & Impact, *Bureau of Standards Journal of Research*, Vol. 18, June 1937, pages 723-725.

The "catch" lay in a type of suspension having low hysteresis, low spring constant, a fixed pivot point, and sufficient rigidity against linear forces. Beldon springs were adopted after several types of bearing pivots were tested and discarded. The pickup shown in Fig. 3 has a resonant frequency of between one and two cycles a second. Damping is provided in the same manner as in the accelerometer. The pickup measures angular vibrational deflection accurately at all frequencies above 200 c.p.m. with a range of $\pm 3°$ and an accuracy of better than one-half minute.

Ordinarily a linear displacement pickup is out of the question for aircraft use, because of the high amplitudes encountered. Vertical low-frequency wing vibration, for example, may occasionally have an amplitude of more than 6″. In order to measure this by present methods we must have a pickup large enough to allow a suspended mass to remain stationary while the case in which it is mounted moves the full amplitude of the wing tip. The natural frequency of the mass on its mounting spring must be well under one cycle per second. Difficulties involved in the construction and use of such a machine are obvious.

A linear displacement pickup, having characteristics similar to those of the torsional instrument described above, may be made by mounting side by side two torsion pickups that are slightly off-balance. A perfect balance wheel will not respond to linear forces, but if it is given a small unbalance it will rotate when the pivot is displaced linearly. We may control the resonant frequency of the system by adjustment of the moment of inertia and restoring spring constant, and we may control its response to linear forces by the amount of unbalance we apply. By the elementary laws of physics the percent response of such a wheel is the same as the per cent unbalance: if a wheel has 5% unbalance at a given point, that point will move, with respect to its pivot, 5% of the linear amplitude of the pivot. Two of these may be connected in such a way that response to rotational motion will cancel out. An amplitude of 4″ may thus be reduced mechanically to an amplitude of 0.2″ and measured with an accuracy of 0.5% in a device whose longest dimension is 3″.

When measuring vibration, it usually is most advantageous to use a pickup having an output proportional to velocity rather than to displacement or acceleration. Such a pickup favors neither the high nor low frequencies, since its output is proportional to the product of amplitude and frequency and is thus a measure of the energy being imparted to, or radiating from, a vibrating body. Measurement of vibration velocity may be made with the torsional pickup described above by using direct current excitation. Velocity measurements are obtained with the accelerometers in two ways: (1) by highly damping the armature magnetically or hydraulically so that the moving parts are essentially resistance controlled,[2] and (2) by integrating the output of the accelerometers with an electrical integrating circuit. In the latter case the frequency range is limited at the lower end by characteristics of the integrating circuit and at the upper end by those of the accelerometer suspension. With the highly damped armature, however, the frequency range is almost unlimited; and thus we may have a pickup incorporating all of the advantages of a moving-coil type with none of the disadvantages.

Use of the variable reluctance principle requires a high frequency a-c. source of constant voltage. After some experimental work a stabilized tuning fork oscillator was chosen for this purpose. The fork has a frequency of 500 c.p.s. and is driven magnetically. Feedback is used on the single 38 tube employed, to provide rapid starting and constant output under varying load and power. The output of this oscillator is distributed to four bridge circuits by a special transformer having four electrostatically shielded secondary windings. A second self-excited relaxation oscillator is fed by a portion of the output of the 500-cycle oscillator in such a way that relaxation occurs every tenth cycle of the latter, giving a 50-cycle sharply-peaked wave that is used to provide a timing trace.

Since in the present apparatus four channels are used simultaneously, it was necessary to alter the original circuit as shown in Fig. 4. One control is for amplitude or range and the other for balance. Each pickup has its own input winding, controls, amplifier, and rectifier. The amplifier consists of one power stage and one stage of voltage amplification which is used in conjunction with an integrating circuit and which is normally bridged. The power amplifier, a 38 tube, operates through a transformer into a full wave rectifier, a 6ZY5 tube, and the output of this is filtered free of carrier wave and recorded. Efficiency of the rectifier is approximately 50%, and the output impedance is of the order of 600 ohms.

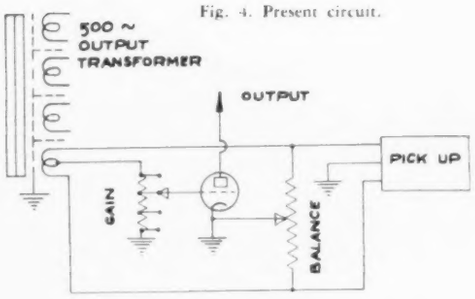


Fig. 4. Present circuit.

Power is from 110-volt 60 cycle source. To supply this a motor generator is used, operating from 12-volt batteries which are standard equipment in present airplanes.

With this equipment it is possible to record simultaneously from four separate sources. Photo "B" shows such equipment in the DC-4 on a flight test. All controls are arranged on one panel so that any combination of pickups, timer, or other type of signal may be recorded. An output meter may be switched into any circuit to provide simultaneous visual indication while recording and to aid in balancing the bridge. Sufficent power is provided by the amplifier to drive a string oscillograph or a crystal pen recorder. Excellent results have been obtained from the equipment on a number of test flights.

A New Method of Testing Accelerometers

Concluded from page 323

is adjusted so that plate A can be held from rotating by stop L while plate C is rotating. The accelerometer is mounted so that its pointer does not deflect under the acceleration while A is kept from rotating. The belt connection between pulleys R and F is in place. When the turntable is brought exactly to the speed corresponding to the desired acceleration, electromagnet E is operated, pulling stop L out of contact. Plate A then rotates with respect to the turntable. The rotation is stopped when plate A has revolved for the desired fraction of a revolution or number of revolutions by releasing the electromagnet to return stop L to position.

It is obvious that by eliminating one strip S or by selective operation of the electromagnet, one or more cycles, as desired, of simple harmonic acceleration can be imposed on the accelerometer.

Control of the amplitude and frequency of the imposed acceleration, as well as the correction for local rotation, have been discussed in the previous section on "Continuous simple harmonic acceleration."

The speed of rotation of the turntable increases somewhat as the frictional drag of the friction clutch is removed by allowing plate A to rotate. The foot-operated brake previously mentioned can be set to give a compensating friction and then be put into operation simultaneously with the friction clutch.

As the local rotation is stopped the instrument is subjected to a negative acceleration by the impact which may in some instruments mask the result desired. This is minimized by interposing shock-absorbing material, such as sponge rubber, between stop L and strips S_1 and S_2. If a recorder is tested, or a photographic record of indication is obtained, running several cycles will separate this effect from the reading desired.

[2] Suggested by Mr. D. P. Loye, Electrical Research Products Inc.

United Air Lines' Instrument Servicing

Concluded from page 321

This inspection procedure is so thorough that United engineers have had to design, develop and manufacture much of the special testing equipment, either because the needed equipment was not available or because it would have been too expensive to have it built specially on the outside, by companies located far from Cheyenne.

Instrument overhaul in United's Cheyenne shop is more than a matter of correcting irregularities of performance. The aim is to provide a rigid inspection and testing procedure that will "head-off" possible failures or irregularities.

The instrument shop proper in Cheyenne, of course, is a dust-proof room. Even so, glass covers are much in evidence to cover up instrument parts which must remain in the open. A filtering system is employed to further reduce dust particles to a minimum, but every precaution is taken with each individual instrument, including the glass coverings.

Instrument upkeep and repair by the airlines has reached such a high point of efficiency that the report of an instrument variation has become a rare occurrence. Each transport plane, for instance, is equipped with two altimeters. Since pilots at all times must be clearly aware of their altitude above terrain two instruments are installed in each ship so that they may be checked against each other and so that the pilots would have a spare altimeter if one by chance should go out. Almost invariably, because of the fine precision work performed in the instrument shop, these twin altimeters are found to coincide perfectly throughout their service periods.

Like most of the other branches of air transport, the instrument shop never has a chance to rest on its laurels. New instruments and new methods and new improvements in old instruments and old methods constantly are being devised, and the instrument overhaul and repair shop has to keep as modern as tomorrow's newspaper.

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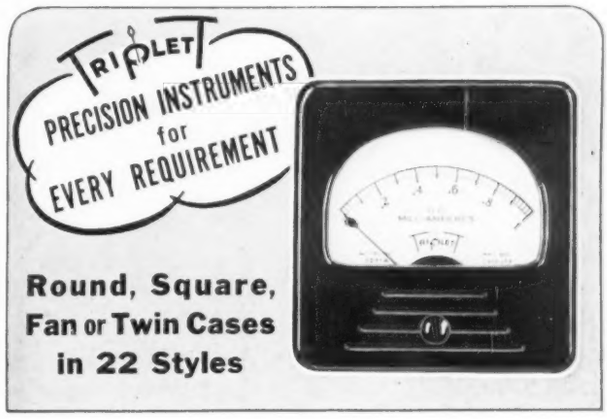

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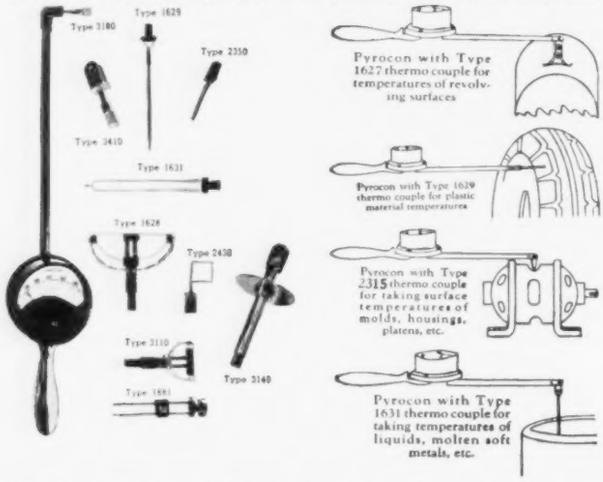
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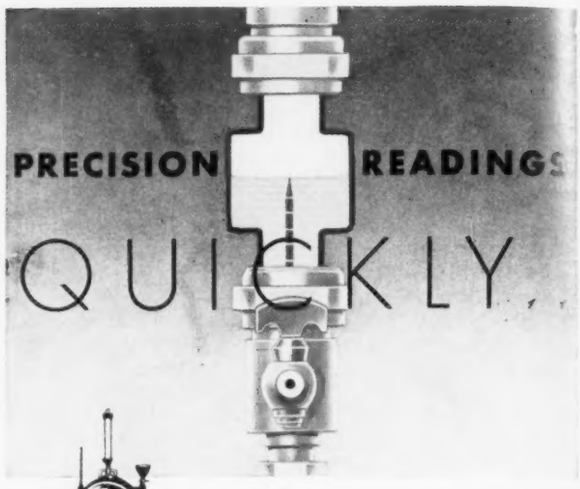

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SPECIAL ISSUE OF

Vol. 12, No. 1
January, 1939
Price $2.00
In Two Parts

Instruments THE MAGAZINE OF MEASUREMENT and CONTROL

PART TWO—THE 1939 INSTRUMENTS INDEX

More Than a Directory

CONTAINING the answers to 99% of the inquiries which *Instruments* receives from subscribers, this Supplement may be likened to a set of phonograph records: it can only be "played" by a "pick-up" The simple "pick-up," which will place at your instant command a wealth of information, is merely your getting acquainted with this Supplement by reading this page. Therefore, it will amply repay you to do so now.

The Index Section—"who makes what"—is the most important. Anyone who wants to know where he can buy or secure information on a certain product can turn to this section, find the product properly indexed and cross-indexed, and see under it the names of the manufacturers and sole representatives. The names under each heading are those of the firms claiming to be the manufacturers (or the sole representatives) of those items.

Indexing System. Products are indexed under the main word. In cases where a name is ambiguous, or where the item is known equally well under two or more names, companies making such devices are listed under one subject and cross-references inserted under the other headings.

Specific Terms. You never are in need of "a gage" but of some particular kind of gage. Therefore we do not list manufacturers under broad general designations. For example, we do not list any names under the main heading "Meters" but we give the sources of supply for numerous classes and types of meters. You will find frequency meters under "F," liquid meters under "L," etc. Moreover, we do not list any names under "Liquid Meters" alone, but we give under proper sub-heads the sources of supply for whatever *class* and *type* of liquid meter you need.

Trade Names. An effort has been made to remove all proprietary trade names from the Index Section.

Correctness of Designations. We have endeavored to list no firm names under specific main headings unless the instruments made by such firms belong there by virtue of their design and construction.

For example, an instrument for measuring Humidity (which is the water-vapor content of air and gases) does not belong under Moisture which is a term reserved for the liquid-water content; and vice-versa.

Also a Colorimeter is an instrument for quantitatively measuring the chromaticity of a specimen by determining spectral distribution of transmitted or reflected luminous energy; and instruments called "colorimeters" which cannot yield color specifications belong under Color Comparators, Color Matchers, etc.

The same applied to sub-heads. Examples:

(a) An instrument called the "——— Recorder" which does not produce a permanent graphic record on a chart or tape or film, is not a recorder; it may possibly be a "maximum-registering" or other type different from the ordinary indicating type.

(b) An instrument called the "Integrating ———" or "Totalizing———" may be nothing but a counting type, belonging under the sub-head "Counting."

Completeness. More than 1000 manufacturers were canvassed by The Instruments Publishing Company in the last four months. Those that did not fill in our first questionnaire after one month received a second one. Again, a third questionnaire was sent to non-responders at the end of the second month. In the last few weeks we even sent representatives to call on manufacturers, urging them to check every listed item they made. Therefore, the omission of any manufacturer's name under any heading is due to the negligence of someone in his own organization.

Every effort has been made to restrict the names in the Index Section to (1) the actual manufacturers and (2) the sole authorized sales agencies of manufacturers who do not or cannot conveniently sell directly to you. On the other hand, whenever you desire to order at one time a variety of equipment, made by numerous firms, you may find it most convenient to get in touch with a recognized, competent, "laboratory supply house." These houses are listed under "Apparatus, Laboratory," on page 4.

Instruments' Further Service. This Index contains the answers to *only* 99% of your inquiries. If you cannot find the product or the name you want, don't hesitate to communicate with the Information Section, Instruments Publishing Co., 1117 Wolfendale St., Pittsburgh, and every effort will be made to furnish the information promptly.

Suggestions. We shall appreciate suggestions regarding:

1. Headings not at present found in this Index which should be there,
2. Firms listed erroneously, and
3. Other inaccuracies which may have crept in despite all precautions.

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Bristol Co.

AMMETERS, Milliammeters
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Cambridge Inst. Co.
Clough-Brengle Co.
De Jur-Amsco Corp.
Engelhard, Chas.
Esterline-Angus Co.
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Lundquist Tool & Mfg.
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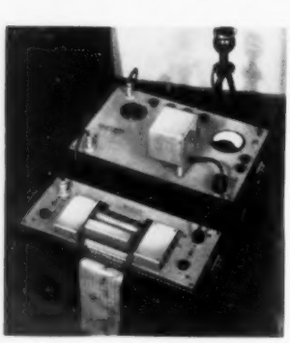

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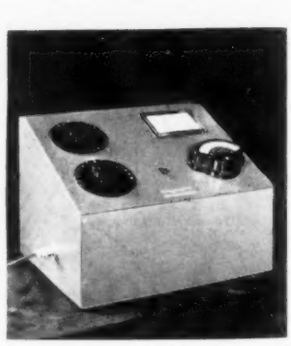

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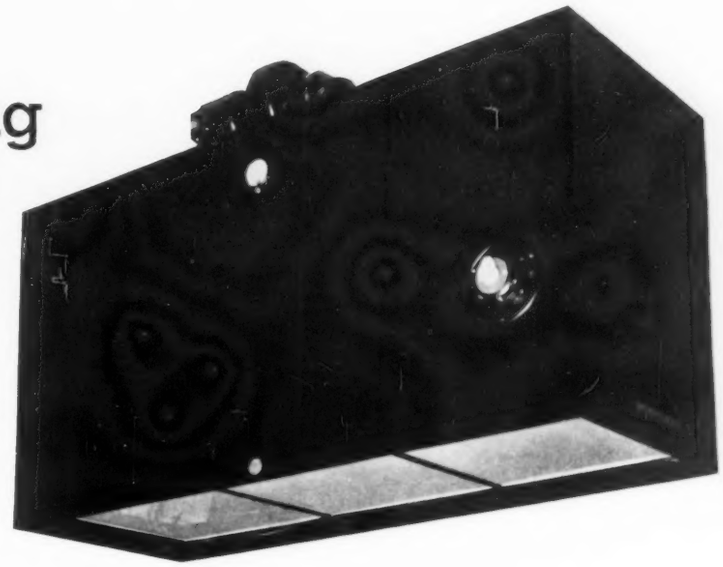

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ANALYZERS, Radio Set
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Electronic Design Corp.
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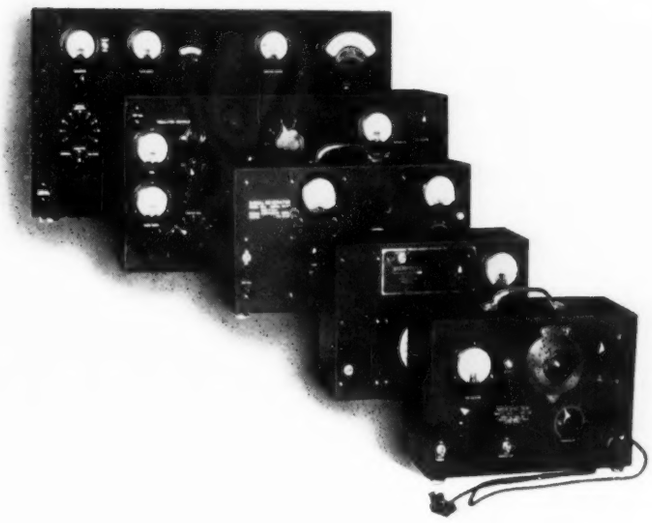

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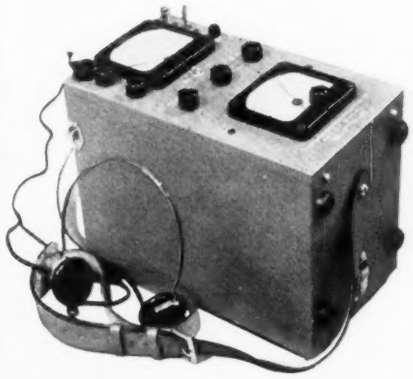

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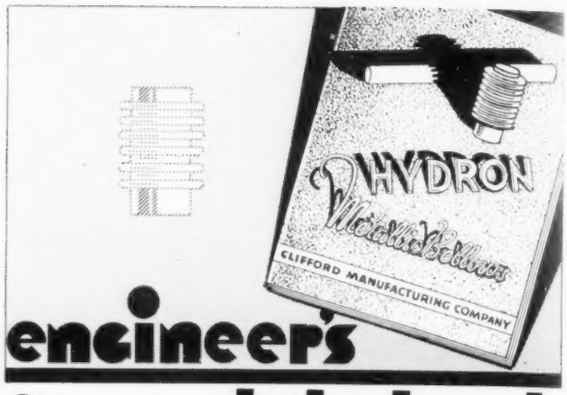

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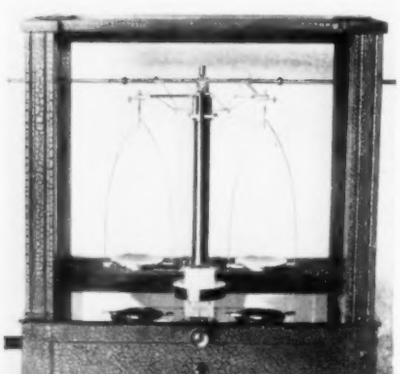

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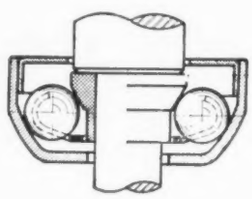

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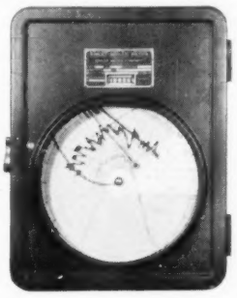

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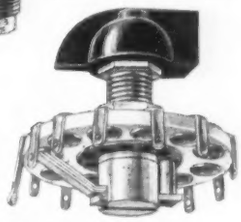

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COLLINGDALE, PA.

Switches • Resistors • Instruments

For addresses, see pages 54-58

CALORIMETERS, Peroxide Bomb
Parr Instrument Co.

CALORIMETERS, Steam
Ellison Draft Gage Co.
Wilkens-Anderson Co.

CALIBRATING BEAMS
Holz, Herman A.

CALIPERS, Square
Starrett Co.

CAMERAS, SCIENTIFIC
Baird Associates
Cambridge Inst. Co.
Electro-Medical Lab.
Fecker, J. W.
Hoffman Co., S. O.
Kern Co.
Mace Instrument Co.
Perkin, Elmer & Moffitt
Zeiss, Inc., Carl

CAMERAS, SCIENTIFIC, Back Reflection
Hayes Scientific App.

CAMERAS, SCIENTIFIC, Diffraction
American Inst. Co.

CAMERAS, SCIENTIFIC, Motion Picture
Bell & Howell
Eastern Science Co.
Geophysical Inst. Co.

CAMERAS, SCIENTIFIC, Motion Picture X-Ray
American Askania Corp.

CAMERAS, SCIENTIFIC, Photo Micro (See Microscopes, Metallographic)

CAPACITANCE METERS
Andrew, Victor J.
Biddle Co., Jas. G.
Cambridge Inst. Co.
Clough-Brengle Co.
Electronic Design Corp.
General Elec. Co.
General Radio Co.
Jackson Electrical Inst.
Leeds & Northrup Co.
RCA Mfg. Co., Inc.
Rubicon Co.

CAPACITORS, Air
Andrew, Victor J.
Cambridge Inst. Co.
Cardwell Mfg. Corp.
General Radio Co.
Leeds & Northrup Co.

CAPACITORS, Electrolytic
Aerovox Corp.
Cornell Dubilier
Crowley & Co.
General Elec. Co.
Magnavox Co.
Potter Co.
Tobe Deutschmann Corp.

CAPACITORS, Mica
Cambridge Inst. Co.
Cornell Dubilier
General Elec. Co.
General Radio Co.
Industrial Inst. Inc.
RCA Manufacturing Co.
Leeds & Northrup Co.
Potter Co.
Rubicon Co.
Sangamo Electric Co.
Solar Mfg. Corp.

CAPACITORS, Paper
Cornell Dubilier
Tobe Deutschmann Corp.

CAPACITORS, Precision
Leeds & Northrup Co.

CAPACITORS, Variable
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Cardwell Mfg. Co.
General Radio Co.
Leeds & Northrup Co.
Rubicon Co.

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Clough-Brengle Co.
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Leeds & Northrup Co.
Premier Crystal Labs.
Radio City Products Co.
RCA Manufacturing Co.
Rubicon Co.
Solar Mfg. Corp.
Weston Elec. Inst. Corp.

CARBON DIOXIDE METERS (See Gas Analyzers, Carbon Dioxide)

CARBON MONOXIDE METERS (See Gas Analyzers, Carbon Monoxide)

CARBON PILES (See Resistors, Carbon Compression)

CATHETOMETERS
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Cambridge Inst. Co.
Central Scientific Co.
Ferner Co.
Fuess, Inc.
Gaertner Scientific Corp.
Mico Instrument Co.

CATHODE RAY TUBES (See Oscillographs, Cathode Ray)

CELLS, Conductivity Cell
Eimer & Amend
Industrial Inst. Inc.
Leeds & Northrup Co.

CELLS, Kerr
Batcher, Ralph R.
General Physical Lab.

CELLS, Photoelectric
Burt Scientific Labs.
Continental Elec. Co.
Eby, Inc.
Electronic Lab.
Electronic Prod. Co.
General Elec. Co.
General Scientific Corp.
G-M Labs.
Hickok Elec. Inst. Co.
Intercontinental Marketing
Lammert & Mann Co.
Loewenberg, F.
Lumenite Elec. Co.
Luxtrol Co., Inc.
Pfaltz & Bauer, Inc.
Photobell Corp.
Rhamstine, J. Thos.
RCA Manufacturing Co.
United Cinephone Corp.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

CELLS, Standard
Cambridge Inst. Co.
Eppley Lab.
Leeds & Northrup Co.
Rubicon Co.
Weston Elec. Inst. Corp.

CEMENT APPARATUS (See Testers & Testing Machines, Cement)

CEMENTING GAGES (See Gages, Cementing)

CEMENT MOLDS
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Fisher Scientific Co.
Humboldt Mfg. Co.
Precision Scientific Co.
Standard Concrete App.

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Humboldt Mfg. Co.

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Fisher Scientific Co.
Williams Apparatus Co.
Southwestern Elec. Labs.

CENTRIFUGES, Paper Testing
Williams Apparatus Co.

CENTRIFUGES, Oil Testing
Bockel & Co.
Braun Corp.
Central Scientific Co.
Eclipse Aviation
International Equip.
Precision Scientific Co.
Tagliabue Mfg. Co.
Thomas Co., Arthur H.
Western Machinery Co.
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CHAINS, SURVEYOR'S (See Surveying Instruments)

CHECKERS, RADIO TUBE (See Analyzers, Radio Set)

CHEMICAL DENSITY, Indicators
Electronic Prod. Co.
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Tagliabue Mfg. Co.
United Cinephone Corp.

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Tagliabue Mfg. Co.
United Cinephone Corp.

CHEMICAL DENSITY, Recorder-Controller
Electronic Prod. Co.
Mine & Smelter Sup. Co.
Tagliabue Mfg. Co.

CHEMICAL FEEDERS, Automatic pH Control
Electronic Prod. Co.
Everson Mfg. Co.
International Filter Co.
Leeds & Northrup Co.
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Builders Iron Foundry
Cochrane Corp.
Colloid Equip. Co.
Fischer & Porter
Gump Co., B. F.
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Jeffrey Mfg. Co.
Mine & Smelter Sup. Co.
Omega Machine Co.
Richardson Scale Co.
Syntron Company
Wallace & Tiernan Prod.

CHEMICAL PORCELAIN (See Porcelain, Laboratory)

CHLORINE CONTROL APPARATUS (See Controllers, Automatic, Chlorine)

CHLORINE TESTING APPARATUS (See Testers, Chlorine)

CHOKES
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Annis Co.
Clough-Brengle Co.
Martin-Decker Corp.
Ohmite Mfg. Co.
Raytheon Mfg. Co.
Thordarson Elec. Co.
United Transformer Corp.

CHOKES, Precision metering, for flowtests on oilwells
Ruska & Co., Inc.

CHRONOGRAPHS
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Artsto Import Co.
Burke, Louis
Cambridge Inst. Co.
Ducommun Co.
Electro-Medical Lab.
Esterline-Angus Co.
Fecker, J. W.
Gaertner Scientific Corp.
Jaeger Watch Co.
Jardin Import Co.
Pierce Watch Co.
Precision Ther. & Inst.

CHRONOMETERS (See Watches)

CLASSIFIERS, Particle Size, Air
Colloid Equip. Co.
Federal Pneumatic Sys.

CLINOGRAPHS, Bore Hole Geophysical Inst. Co.
Sperry-Sun Well Survey'g

CLOCKS, A-c. Electric
Ansonia & Tork Clock
Brown Inst. Co.
Cincinnati Time Rec. Co.
Consol. Ashcroft-Hancock
General Elec. Co.
Hammond Instrument Co.
Howard Clock Products
Lux Clock Mfg. Co.
Middlebury Elec. Clock
Standard Elec. Time
Stromberg Electric Co.
Thomas Clock Co.
Warren Telechron Co.
Zenith Electric Co.

CLOCKS, D-c. Electric
Brown Inst. Co.
Howard Clock Products
Jaeger Watch Co.
Standard Elec. Time
Stromberg Electric Co.
Thomas Clock Co.
Zenith Electric Co.

CLOCKS, Master
Cincinnati Time Rec. Co.
Gaertner Scientific Corp.
General Elec. Co.
Howard Clock Products
International Bus. Mach.
Paragon Electric Co.
Standard Elec. Time
Stromberg Electric Co.
Thomas Clock Co.
Warren Telechron Co.
Zenith Electric Co.

CLOCKS, Minute Impulse & Synchronous
Cincinnati Time Rec. Co.
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Elec. Tachometer Corp.
General Elec. Co.
Howard Clock Products
International Bus. Mach.
Paragon Electric Co.
Standard Elec. Time Co.
Stromberg Electric Co.
Thomas Clock Co.
Warren Telechron Co.
Zenith Electric Co.

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Ansonia & Tork Clock
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Burke, Louis
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General Electric Co.
Howard Clock Products
International Bus. Mach.
Standard Elec. Time
States Co.
Stromberg Electric Co.
Thomas Clock Co.
Warren Telechron Co.
Zenith Electric Co.

CLOCKS, Primary
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General Elec. Co.
Howard Clock Products
International Bus. Mach.
Stromberg Electric Co.
Thomas Clock Co.

CLOCKS, Secondary
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Cincinnati Time Rec. Co.
General Elec. Co.
Howard Clock Products
International Bus. Mach.
Standard Elec. Time
Stromberg Electric Co.
Thomas Clock Co.

CLOCKS, Standard
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Jaeger Watch Co.
Kollsman Inst. Co.
Standard Elec. Time

CLOCKS, Stop
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Fish-Schurman Co.
Glogau & Co.
Jaeger Watch Co.
Paragon Electric Co.
Standard Elec. Time
Tagliabue Mfg. Co.
Thompson Clock Co.
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Ruehlfel Co.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Western Machinery Co.

COAL METERS
Bailey Meter Co.
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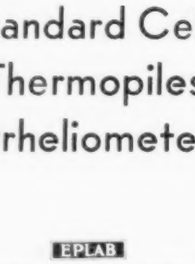

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Pioneer Instrument Co.
White Co., Inc.

COLOR ANALYZERS, Photoelectric
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Eimer & Amend
Electronic Prod. Co.
Ess Inst. Co.
Fisher Scientific Co.
Gaertner Scientific Corp.
General Elec. Co.
General Radio Co.
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Klett Mfg. Co.
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Pfaltz & Bauer, Inc.
Photobell Corp.
Rawson Elec. Inst. Co.
Rubicon Co.
Saxl Instrument Co.
Southwestern Elec. Labs.
United Cinephone Corp.

COLOR COMPARATORS, Photoelectric (See Color Analyzers, Photoelectric)

COLOR COMPARATORS, Visual
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Baird Associates
Barkon-Frink
Bausch & Lomb Optical
Central Scientific Co.
Electronic Research Labs.
Fisher Scientific Co.
Gaertner Scientific Corp.
Hays Laboratories
Hellige, Inc.
LaMotte Chemical Prod.
Leitz, Inc.
Luxtrol Co., Inc.
Munsell Color Co.
Rascher & Betzold
Saxl Instrument Co.
Tagliabue Mfg. Co.
Taylor & Co., Inc., W. A.
United Cinephone Corp.
Zeiss, Inc., Carl

COLOR GRADERS (See Color Analyzers, Photoelectric)

COLOR MATCHING OUTFITS (See Color Comparators, Visual)

COLORIMETER TUBES (See Colorimeters, Visual)

COLORIMETERS, Photoelectric
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Frober-Faybor Co.
General Elec. Co.
Hays Laboratories
Higgins, Charles F.
Klett Mfg. Co.
Luxtrol Co., Inc.
Pfaltz & Bauer, Inc.
Photobell Corp.
Rubicon Co.
Saxl Instrument Co.
Scientific Glass App.
Southwestern Elec. Labs.
United Cinephone Corp.

COLORIMETERS, Visual
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American Inst. Co.
Bausch & Lomb Optical
Central Scientific Co.
Electronic Research Labs.
Fisher Scientific Co.
Klett Mfg. Co.
Leitz, Inc.
Munsell Color Co.
Rascher & Betzold
Saxl Instrument Co.
Spencer Lens Co.
Zeiss, Inc., Carl

COMBUSTION, Indicators
Bacharach Indus. Inst.
Bailey Meter Co.
Bowser & Co.
Brown Inst. Co.
Crew Equip. Co.
Dwyer Mfg. Co.
Ess Inst. Co.
Friez & Sons
Hays Corp.
Preferred Utilities Mfg.
Republic Flow Meters
Tagliabue Mfg. Co.
Uehling Instrument Co.

COMBUSTION, Recorders
Bacharach Indus. Inst.
Bailey Meter Co.
Brown Inst. Co.
Ess Inst. Co.
Hays Corp.
Republic Flow Meters
Tagliabue Mfg. Co.
Uehling Instrument Co.

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Clough-Brengle Co.
Daven Co.
Elec. Indicator Co.
General Elec. Co.
Hickok Elec. Inst. Co.
Industrial Inst. Inc.
Leeds & Northrup Co.
RCA Manufacturing Co.
Rubicon Co.
Sensitive Research Inst.
Shallcross Mfg. Co.
Weston Elec. Inst. Corp.

COMPARATORS, Mechanical
Federal Prod. Corp.
Ferner Co.
Mico Instrument Co.
North Side Tool Co.
Scherr Co., Inc.

COMPARATORS, Optical
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Cambridge Inst. Co.
Electronic Research Labs.
Ess Inst. Co.
Jones & Lamson Mach.
Leitz, Inc.
Scherr Co., Inc.
United Cinephone Corp.
Van Keuren Co.
Zeiss, Inc., Carl

COMPASSES, Aircraft
American Askania Corp.
Elgin Natl. Watch Co.
Kollsman Inst. Co.
Pioneer Instrument Co.
RCA Manufacturing Co.
Star Compass Co.

COMPASSES, Automobile
Star Compass Co.
U. S. Gauge Co.

COMPASSES Azimuth
Ainsworth & Sons
Keuffel & Esser Co.
Leupold, Volpel & Co.
Pioneer Instrument Co.
Warren-Knight Co.

COMPASSES, Dip
Gurley, W. & L. E.
Keuffel & Esser Co.
Taylor Inst. Cos.
Warren-Knight Co.

COMPASSES, Drafting Room (See Drawing Instruments)

COMPASSES, Gyro
Sperry Gyroscope Co.

COMPASSES, Magnetic
Ainsworth & Sons
Baker Compass Co.
Geophysical Inst. Co.
Gurley, W. & L. E.
Keuffel & Esser Co.
Kollsman Inst. Co.
Leupold, Volpel & Co.
Negus, T. S. & J. D.
Pioneer Instrument Co.
Star Compass Co.
Taylor Inst. Cos.
Testrite Instrument Co.
Warren-Knight Co.

COMPASSES, Marine
American Askania Corp.
Baker Compass Co.
Bendix Marine Products
Bliss & Co.
Geophysical Inst. Co.
Marine Compass Co.
Negus, T. S. & J. D.
Star Compass Co.

COMPASSES, Radio
Hickok Elec. Inst. Co.
RCA Manufacturing Co.
Triumph Mfg. Co.

COMPASSES, Ship (See Compasses, Marine)

COMPASSES, Telltale (See Compasses, Marine)

COMPENSATION, Magnetic
Geophysical Inst. Co.

CONCENTRATION RECORDERS
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Leeds & Northrup

CONDENSER, Electric (See Capacitors)

CONDENSER LEAKAGE, Indicators
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Clough-Brengle Co.
Electronic Design Corp.
Hickok Elec. Inst. Co.
Industrial Inst. Inc.
Jackson Electrical Inst.
Leeds & Northrup Co.
Potter Co.
Radio City Products Co.
Rawson Elec. Inst. Co.
Tobe Deutschmann Corp.
Triumph Mfg. Co.
Weston Elec. Inst. Corp.

CONDENSER LEAKAGE, Recorders
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Leeds & Northrup

CONDENSERS (OPTICAL), Abbe
Bausch & Lomb Optical
Central Scientific Co.
Fuess, Inc.
E. Leitz, Inc.
Perkin, Elmer & Moffitt
Pfaltz & Bauer, Inc.
Spencer Lens Co.
Zeiss, Inc., Carl

CONDENSER (OPTICAL), Achromatic
Bausch & Lomb Optical
Central Scientific Co.
Clark & Sons
Fuess, Inc.
General Scientific Corp.
Leitz, Inc., E.
Perkin, Elmer & Moffitt
Pfaltz & Bauer, Inc.
Spencer Lens Co.
Zeiss, Inc., Carl

CONDENSER (OPTICAL), Apochromatic
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Leitz, Inc.
Perkin, Elmer & Moffitt
Spencer Lens Co.
Zeiss, Inc., Carl

CONDENSER (OPTICAL), Bull's Eye
Bausch & Lomb Optical
Perkin, Elmer & Moffitt
Spencer Lens Co.

CONDENSER (OPTICAL), Cardioid
Bausch & Lomb Optical
Perkin, Elmer & Moffitt
Pfaltz & Bauer, Inc.
Zeiss, Inc., Carl

CONDENSER (OPTICAL), Glass
Ace Glass Inc.
Bausch & Lomb Optical
Clark & Sons
Fish-Schurman Co.
Fuess, Inc.
General Scientific Corp.
Griebel Instrument Co.
Master Optical Co.
Perkin, Elmer & Moffitt
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Specialty Glass Co.
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CONDENSER (OPTICAL), Paraboloid
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Bausch & Lomb Optical
Clark & Sons
Fish-Schurman Co.
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Leeds & Northrup Co.
Natl. Aluminate Corp.
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CONES, Pyrometric
Accurate Pyrometric Cone
Fish-Schurman Co.
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CONES, Slump
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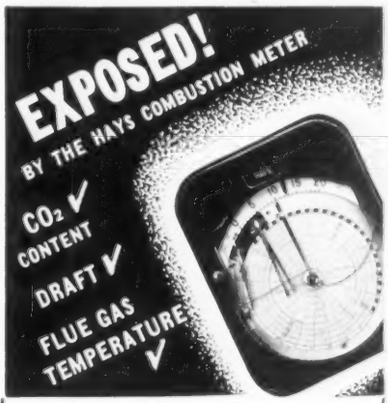

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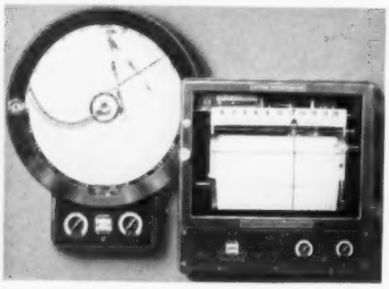

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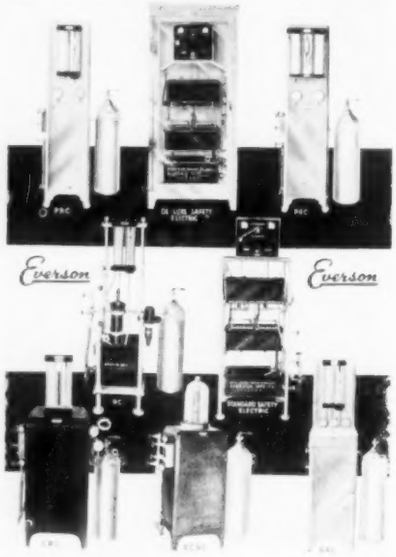

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Green, Arthur B.
Mason-Neilan Regulator
Merrit Engr. & Sales

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Foster Engg. Co.
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Natural Gas Equipment
Northern Equip. Co.
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Elgin Softener Corp.
Henszey Co.
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Republic Flow Meters Co.
Trane Co.
Fischer & Porter

CONTROLLERS, AUTOMATIC, Bulk Material Level
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Askania Regulator Co.
Builders Iron Foundry
Everson Mfg. Co.
LaMotte Chemical Prod.
National Meter Co.
Rascher & Betzold
Victor Equipment Co.
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CONTROLLERS, AUTOMATIC, Combustion
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Askania Regulator Co.
Bailey Meter Co.
Brooke Eng. Co.
Brown Inst. Co.
Cambridge Inst. Co.
Cash Co.
Consulting & Engineering
Crew Equip. Co.
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Leeds & Northrup Co.
Mason-Neilan Reg. Co.
National Airoil Burner
National Brass Co.
Natural Gas Equipment
Paragon Electric Co.
Penn Electric Switch Co.
Partlow Corp.
Republic Flow Meters
R-S Products Corp.
Ruggles-Klingemann
Selas Company
Wilgus Manufacturing

CONTROLLERS, AUTOMATIC, Condensation
Bailey Meter Co.
Boylston Co.
Fisher Governor Co.
Friez & Sons
General Regulator Corp.
Industrial Instrument Co.
Taglabue Mfg. Co.
Taylor Inst. Cos.
Trane Co.

COMPLETE INSTRUMENTATION

for INDUSTRIAL PROCESSES

CONTROLLERS for temperature, pressure, absolute pressure, rate of flow and liquid level. Air-operated potentiometer controllers. Exclusive features resulting in unexcelled performance.

RECORDERS of temperature, pressure, flow level, motion and absolute pressure.

INDICATORS of temperature, pressure, flow and level.

TRANSMISSION SYSTEMS, pneumatic type with exceptionally fast response. Electric signalling systems.

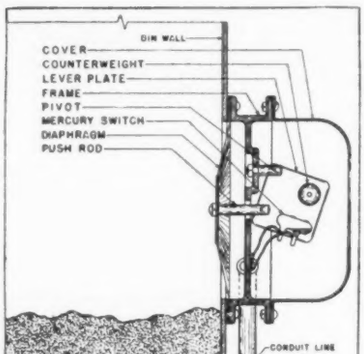
1185 ADAMS STREET — MASONEILAN — BOSTON, MASS. U.S.A.

REG. U. S. PAT. OFF.

CONTROL SPECIALISTS SINCE 1882

BIN LEVEL CONTROL

FOR BULK MATERIALS, SEMI-LIQUIDS, LIQUIDS



The Bin-Dicator in cross section showing diaphragm and switch.

ON HOPPERS and BINS

Indicates level of materials, automatically controls elevating and conveying equipment in response to fluctuating levels.

ON CONVEYORS ELEVATOR BOOTS

Indicates overfeeding, automatically shuts off drive to prevent choking.

ON WEIGHING and BLENDING EQUIPMENT

Automatically shuts off scales or feeders if material supply fails.

Varying pressure of bulk, semi-liquid or liquid materials against the Bin-Dicator diaphragm operates a mercury switch having 15-amp. rating at 125 volts ac., 10 amp. at 250 volts. Diaphragm and switch are assembled in self-contained design with housing that measures 10 by 6 inches. Two designs for external and internal mounting.

Ask for Typical Installation Wiring Diagrams with Explanatory Notes

THE BIN-DICATOR COMPANY
14615 East Jefferson Avenue Detroit, Michigan

For addresses, see pages 54-58

CONTROLLERS, AUTOMATIC, Condenser Leakage
Leeds & Northrup Co.

CONTROLLERS, AUTOMATIC, Consistency
Bristol Co.
D'Este Co.
Foxboro Co.
Green, Arthur R.
Mason-Neilan Regulator
Merrit Engr. & Sales
Northern Equip. Co.

CONTROLLERS, AUTOMATIC, Current (See Regulators)

CONTROLLERS, AUTOMATIC, Cycle
Autocall Co.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Cramer & Co., Inc.
Denver Fire Clay Co.
Elec. Switch Corp.
Foxboro Co.
Hanlon-Waters, Inc.
Industrial Instrument Co.

CONTROLLERS, Automatic, Cycle (Cont'd)
Leeds & Northrup Co.
Mason-Neilan Reg. Co.
Monitor Controller Co.
Southwestern Elec. Labs.
Tagliabue Mfg. Co.
Taylor Inst. Cos.

CONTROLLERS, AUTOMATIC, Damper
Area Regulators, Inc.
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Barber-Coleman Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Cook Electric Co.
Davis Reg. Co.
Denver Fire Clay Co.
Detroit Lubricator Co.
Electronic Prod. Co.
Foster Eng. Co.
Gleason-Avery, Inc.
Hagan Corp.
Hanlon-Waters, Inc.
Hays Corp.

CONTROLLERS, Automatic, Damper (Cont'd)
Johnson Service Co.
Kiely & Mueller
Leeds & Northrup Co.
Mason-Neilan Regulator
National Airoil Burner
Natural Gas Equipment
Penn Electric Switch Co.
Powers Regulator Co.
Preferred Utilities Mfg.
Republic Flow Meters
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Eng. Co., Inc.
Tagliabue Mfg. Co.
Thrush & Co., H. A.
Trane Co.
Watts Regulator Co.
White-Rodgers Electric
Wilgus Mfg. Co.

CONTROLLERS, AUTOMATIC, Desuperheat
Area Regulators, Inc.
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Hagan Corp.
Leeds & Northrup Co.

CONTROLLERS, Automatic, Desuperheat (Cont'd)
Mason-Neilan Regulator
Mercon Regulator Co.
Northern Equip. Co.
Republic Flow Meters Co.
Spence Eng. Co., Inc.
Tagliabue Mfg. Co.
Taylor Inst. Cos.

CONTROLLERS, AUTOMATIC, Draft
Area Regulators, Inc.
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Barber-Coleman Co.
Boiler Room Equip.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Crew Equip. Co.
Denver Fire Clay Co.
Foster Eng. Co.
General Regulator Corp.
Gleason-Avery, Inc.
Hagan Corp.

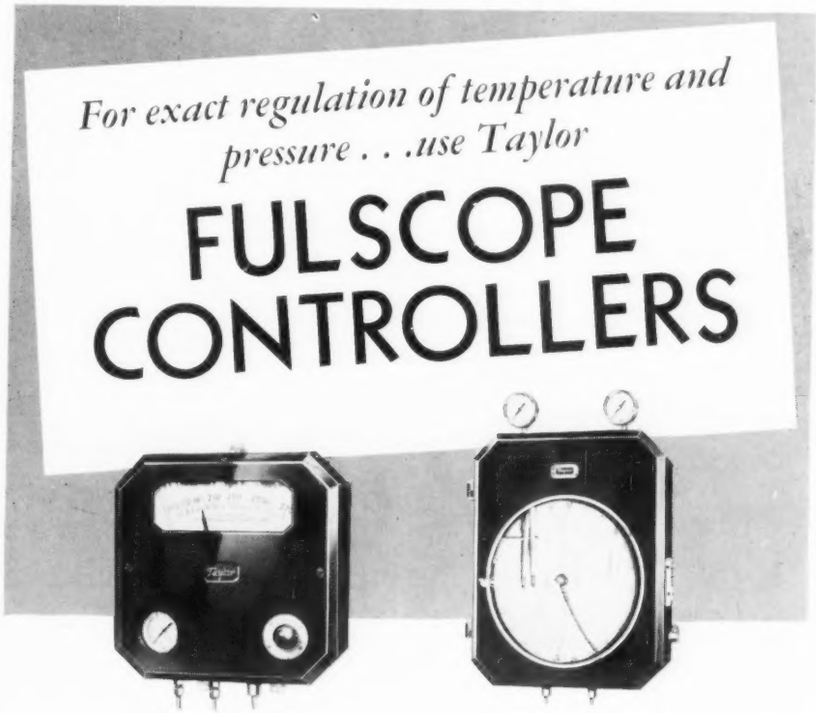
(Continued on next page)

Foxboro makes a comprehensive line of Air- and Electric-Operated Controllers for temperature, pressure, flow, liquid level and humidity. The control systems include every type from the simple Open-and-Shut Control to the Foxboro Stabilog Control System—providing the ideal type of control for every job.

For information concerning the entire line of Foxboro Instruments and Controllers refer to "Sweet's Catalog", or write for a copy of Bulletin No. 199-2. The Foxboro Company, 46 Neponset Avenue, Foxboro, Mass., U.S.A. Branch offices in 25 Principal Cities.

For exact regulation of temperature and pressure . . .use Taylor

FULSCOPE CONTROLLERS



Fulscope Indicating Controller

Fulscope Recording Controller

These indicating and recording controllers are sturdy, precise, highly adaptable.

THE BRAINS of many Taylor Systems are the famous Fulscope Controllers. These instruments, equipped with the original Universal Sensitivity Adjuster, are adaptable to practically any operating condition. Because of their simple construction and interchangeable parts, plants are able to standardize on Taylor Instruments throughout. We list below a few of the Taylor Control Instruments.

Some types of Fulscope Controllers

Indicating Temperature and Pressure Controllers, used where temperatures and pressures must be under exact control, but chart records are not necessary.

Recording Temperature and Pressure Controllers, which write on one chart, continuous, permanent records of control maintained. "Singl-Duty" type controls one temperature, "Dubl-Duty" type records two temperatures, or one temperature and one pressure.

Reset Controllers, which regulate temperature or pressure in a predetermined relation to some other varying temperature or pressure.

Dubl-Response Control Instruments, for use on extremely difficult installations, to insure straight-line control, despite varying load changes.

Time Schedule Controllers, which regulate according to a predetermined schedule.

Hygrometers, record and control wet and dry bulb temperatures, maintain relative humidity.

Flow and Liquid Level Controllers. Both indicating and recording types. (Described elsewhere in this publication.)

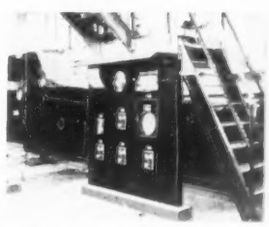
Self-Acting Temperature Controllers for use where compressed air is not available.

Get in touch with the Taylor Representative. Catalog sent on request. Taylor Instrument Companies, Rochester, N. Y. Plant also in Toronto, Canada.

Taylor

Indicating / Recording • Controlling

TEMPERATURE, PRESSURE, FLOW *and* **LEVEL INSTRUMENTS**



BAILEY METER *Combustion* CONTROL

● Bailey Meter Automatic Combustion Control of boilers results in substantial saving in fuel; increased boiler capacity; reduction of boiler and furnace maintenance; more time for operators to devote to general station maintenance; and improvement in the general character of service.

Bailey Meter Control makes possible the everyday operation of boilers at test efficiencies because it is a complete combustion control system which (1) automatically maintains steam pressure by supplying fuel and air simultaneously to boilers in accordance with changes in steam demand, (2) automatically maintains most economical fuel-air ratio by incorporating the Bailey Boiler Meter as an integral part of the system, (3) automatically maintains the desired furnace draft, and (4) automatically distributes load among boilers so that each unit carries its share.

This sturdy inexpensive air-operated control system has been applied to all sizes and types of boilers ranging from 200 h.p. upward. It is applicable to all fuels and all methods of firing.

For further information consult Sweet's Engineering Catalogs or write for bulletin No. 102-A.

BAILEY METER COMPANY
1041 IVANHOE ROAD · CLEVELAND, O.
Bailey Meter Company Ltd., Montreal, Canada

For addresses, see pages 54-58

CONTROLLERS, Automatic, Condensation (Cont'd)
Hays Corp.
Leeds & Northrup Co.
Mason-Neilan Regulator
National Airoil Burner
National Brass Co.
Preferred Utilities Mfg.
Republic Flow Meters
R-S Products Corp.
Ruggles-Klingemann
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thrush & Co., H. A.
Trane Co.

CONTROLLERS, AUTOMATIC, Feed Water
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Consol. Ashcroft Hancock
Eclipse Fuel Eng. Co.
Hagan Corp.
Hanlon-Waters, Inc.
Hensley Co.
Kiely & Mueller
Mason-Neilan Reg. Co.
McAlear Mfg. Co.
McDonnell & Miller
Mercoid Regulator Co.
Natural Gas Equipment
Northern Equip. Co.
Republic Flow Meters
Ruggles-Klingemann
Schade Valve Mfg. Co.
Thrush & Co., H. A.
Watts Regulator Co.
Wilcus Mfg. Co.

CONTROLLERS, AUTOMATIC, Filter Rate
Cochrane Corp.
International Filter Co.
Mason-Neilan Reg. Co.
Taylor Inst. Cos.

CONTROLLERS, AUTOMATIC, Float
Allen Bradley Co.
Autocall Co.
Automatic Control Co.
Automatic Temp. Control
Bailey Meter Co.
Cash Co.
Cochrane Corp.
Cutler-Hammer, Inc.
Davis Regulator Co.
Detroit Lubricator Co.
Fluttus Electric Co.
Foster Engg. Co.
Frick Co.
Hagan Corp.
Hanlon-Waters, Inc.

CONTROLLERS, Automatic, Float (Cont'd)
Kiely & Mueller
Mason-Neilan Regulator
McAlear Mfg. Co.
Mercoid Regulator Co.
Penn Electric Switch
Powers Regulator Co.
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Eng. Co., Inc.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Water Level Controls Co.

CONTROLLERS, AUTOMATIC, Flow
American Meter Co.
Bailey Meter Co.
Brown Inst. Co.
Bristol Co.
Cash Co.
Denver Fire Clay Co.
Electrimatic Corp.
Foster Engg. Co.
Foxboro Co.
General Regulator Corp.
Hanlon-Waters, Inc.
International Filter Co.
Leeds & Northrup Co.
Mason-Neilan Regulator
Mercoid Regulator Co.
Republic Flow Meters
Spence Eng. Co., Inc.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thrush & Co., H. A.
Victor Equipment Co.
Wilcus Mfg. Co.

CONTROLLERS, AUTOMATIC, Flow Proportioning
American Meter Co.
Area Regulators, Inc.
Askania Regulator Co.
Autocall Co.
Automatic Temp. Control
Bailey Meter Co.
Barber-Coleman Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Builders Iron Foundry
Cash Co.
Cochrane Corp.
Cutler-Hammer, Inc.
Eclipse Fuel Engg. Co.
Electronic Prod. Co.
Fischer & Porter
General Regulator Corp.
Hagan Corp.
Hanlon-Waters, Inc.

CONTROLLERS, Automatic, Flow Proportioning, (Cont'd)
Hensley Co.
Illinois Engr. Co.
International Filter Co.
Lammert & Mann Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Mercoid Regulator Co.
Republic Flow Meters Co.
Reynolds Gas Regulator
Spence Engr. Co., Inc.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Vergilio Co.
Victor Equipment Co.
Wheelco Inst. Co.

CONTROLLERS, AUTOMATIC, Fluid Proportioning
American Meter Co.
Area Regulators, Inc.
Askania Regulator Co.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Cash Co.
Cochrane Corp.
Electronic Prod. Co.
Fischer & Porter
General Regulator Corp.
Hagan Corp.
Hanlon-Waters, Inc.
International Filter Co.
Mason-Neilan Regulator
Mercoid Regulator Co.
Phipps & Bird, Inc.
Tagliabue Mfg. Co.
Taylor Inst. Cos.

CONTROLLERS, AUTOMATIC, Frequency (See Regulators)

CONTROLLERS, AUTOMATIC, Furnace
Am. Gas Furnace Co.
Area Regulators, Inc.
Askania Regulator Co.
Automatic Elec. Mfg. Co.
Automatic Temp. Control
Bailey Meter Co.
Barber-Coleman Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Cook Electric Co.
Defender Automatic Reg.

CONTROLLERS, Automatic, Furnace (Cont'd)
Denver Fire Clay Co.
Detroit Lubricator Co.
Dickson Co.
Eclipse Fuel Engg. Co.
Friez & Sons
Fulton Sylphon Co.
General Regulator Corp.
Gleason-Avery, Inc.
Hagan Corp.
Hays Corp.
Industrial Engr. Corp.
Johnston Mfg. Co.
Leeds & Northrup
Lindberg Eng. Co.
Mason-Neilan Regulator
McCorkle Co.
National Airoil Burner
National Brass Co.
Natural Gas Equipment
Paragon Electric Co.
Partlow Corp.
Payne Furnace & Supply
Penn Electric Switch
Perfex Corp.
Pyrometer Inst. Co.
Republic Flow Meters
R-S Products Corp.
Ruggles-Klingemann
Sampson Time Control
Spence Engineering Co.
Spencer Thermostat Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
United Cinephone Corp.
Wheelco Inst. Co.
White Mfg. Co.
White-Rodgers Electric
Wilcus Mfg. Co.

CONTROLLERS, AUTOMATIC, Gas Mixing (See Controllers, Automatic, Flow Proportioning)

CONTROLLERS, AUTOMATIC, Granular Material Level
Bin-Dicator Co.

CONTROLLERS, AUTOMATIC, Gravity
Area Regulators, Inc.
Askania Regulator Co.
Bailey Meter Co.
Binckley, G. S.
Mason-Neilan Regulator
Mine & Smelter Supply
Tagliabue Mfg. Co.
Taylor Inst. Cos.

CONTROLLERS, AUTOMATIC, Humidity
American Moistening Co.
Area Regulators, Inc.
Atlas Valve Co.
Barber-Coleman Co.
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft-Hancock
Cramer & Co., Inc.
Detroit Lubricator Co.
Dietert Co.
Electronic Prod. Co.
Fenwal, Inc.
Foxboro Co.
Friez & Sons
General Controls Co.
H-B Inst. Co., Inc.
Industrial Inst. Co.
Johnson Service Co.
Leeds & Northrup Co.
Mason-Neilan Regulator
McDonnell & Miller
Moeller Instrument Co.
Parks-Cramer Co.
Penn Electric Switch
Phila. Thermometer Co.
Powers Regulator Co.
Robertshaw Thermostat
Sarco Co., Inc.
Scientific Inst. Co.
Southwestern Electronics
Stickle Steam Specialties
Supreme Elec. Prods.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thwing-Albert Inst. Co.
Vaughn-G. E. Witt Co.

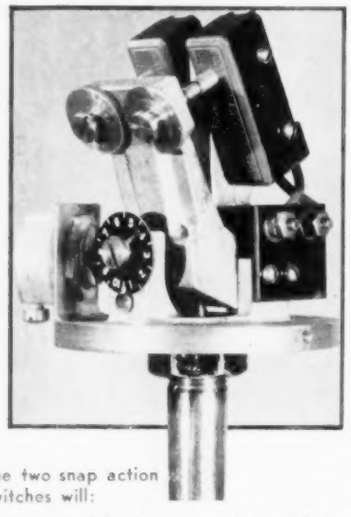
CONTROLLERS, AUTOMATIC, Humidity and Temperature (See Controllers, Automatic, Humidity and Controllers, Automatic, Temperature)
American Inst. Co.

CONTROLLERS, AUTOMATIC, Lighting
Cutler-Hammer, Inc.
Luxtrol Co., Inc.
Paragon Electric Co.
Southwestern Electronics
United Cinephone Corp.
Weston Elec. Inst. Corp.
Zenith Electric Co.

CONTROLLERS, AUTOMATIC, Liquid Level
Allen Bradley Co.
American Meter Co.
Area Regulators, Inc.

CONTROLLERS, Automatic, Liquid Level (Cont'd)
Askania Regulator Co.
Atlas Valve Co.
Autocall Co.
Bailey Meter Co.
Bellfield Co.
Binckley, G. S.
Bin-Dicator Co.
Boylston Co.
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Cash Co.
Cochrane Corp.
Consol. Ashcroft-Hancock
Cutler-Hammer, Inc.
Davis Reg. Co.
Electronic Prod. Co.
D'Este Co.
Elec. Indicator Co.
Fisher Governor Co.
Foster Engg. Co.
Foxboro Co.
Frick Co.
Furnas Electric Co.
General Controls Co.
General Regulator Corp.
Guardian Elec. Mfg. Co.
Hagan Corp.
Hanlon-Waters, Inc.
International Filter Co.
Johnson Service Co.
Kiely & Mueller
Klipfel Mfg. Co.
Lumenite Elec. Co.
Luxtrol Co., Inc.
Mason-Neilan Regulator
McAlear Mfg. Co.
McDonnell & Miller
Mercoid Corp.
Mercoid Regulator Co.
National Airoil Burner
Natural Gas Equipment
Northern Equip. Co.
Paragon Electric Co.
Powers Regulators Co.
Precision Therm. & Inst.
Preferred Utilities Mfg.
Republic Flow Meters
Schade Valve Mfg. Co.
Spence Engineering Co.
Stets Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Tehling Instrument Co.
Water Levels Controls Co.
Watts Regulator Co.
Wheelco Inst. Co.
Wilcus Mfg. Co.

CONTROLLERS, AUTOMATIC, Load (See Regulators)



The two snap action switches will:

A. Control heating or cooling or both.
B. Control the temperature and give either a high or low limit device.
C. Give either two or three step control.
D. Give floating control with reversing control motors.
E. Give two or three speed control of auxiliary motors.

Available for temp. —100 to 1400°F. Other models with special alloy tubes suitable up to 1800°F.

Send for particulars

BURLING INSTRUMENT COMPANY
239-241 Springfield Ave., Newark, N. J.

Bailey FEED WATER Control

● Bailey Meter Company offers three distinct feed water control systems. They are (1) the Thermo-hydraulic Feed Water Regulator which is suitable for the majority of small boilers operating at relatively low pressures. This regulator operates from water level alone and is provided with a fully balanced tight seating V-port regulating valve designed to give a straight line characteristic. It offers the advantages of low installation cost, removable valve parts and independence of valve location.

(2) The Single-Element air-operated feed water control system is recommended for installations on which smooth regulation of feed water flow is desired, and a wide regulating range cannot be used. This system is controlled by water level alone as measured by a Bailey Boiler Drum Water Level Recorder.

(3) Bailey Three-Element feed water control is recommended for high capacity low water storage boilers operating at high pressures or for boilers operating at medium pressures with violent load fluctuations. This system is based on actual measurement of water flow to the boiler, steam flow from the boiler and water level within the boiler, and is adjusted primarily to control the rate of water flow to the boiler so that it equals the rate of steam flow from the boiler.

For detailed information consult Sweet's Engineering Catalogs or request bulletin ● No. 183.

BAILEY METER COMPANY
1041 IVANHOE ROAD · CLEVELAND, O.
Bailey Meter Company Ltd., Montreal, Canada

MAKE YOUR PLANT
EXPLOSION PROOF
24 HOURS A DAY

FLAME-OTROL

is the only instant acting safety control designed to operate on gas, oil or powdered coal. FLAME-OTROL is the only instrument of its kind approved and listed by both Associated Factory Mutual and Underwriters Laboratory.

Write for Bulletin No. 1101

Wheelco Instruments Co.
1933 So. Halsted St. Chicago, Ill.

For addresses, see pages 54-58

Controllers FOR AUTOMATIC REGULATION OF TEMPERATURE, COMBUSTION, pH, ETC.

Micromax Electric Control for temperature, etc., consists of Micromax instrument with valve-drive and relay developed and engineered as a unit to provide speed, sensitivity and accuracy. Simple, easy to install, low in maintenance.

Metermax Combustion Control is a unit system which automatically proportions fuel and air for efficient combustion in boiler and industrial furnaces. Special controls for special problems. Information on request.

LEEDS & NORTHRUP CO.
4984 STENTON AVENUE, PHILADELPHIA

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

CONTROLLERS, AUTOMATIC, Moisture (See Controllers, Automatic, Humidity)

CONTROLLERS, AUTOMATIC, Phase (See Regulators)

CONTROLLERS, AUTOMATIC, Phosphate Feed
Cochrane Corp.
Fischer & Porter
Hagan Corp.

CONTROLLERS, AUTOMATIC, Power Factor (See Regulators)

CONTROLLERS, AUTOMATIC, Pressure
Acme Regulator Co.
Allen-Bradley Co.
Askania Regulator Co.
Area Regulators, Inc.
Atlas Valve Co.
Autocall Co.
Automatic Control Co.
Automatic Temp. Control
Bailey Meter Co.
Baldwin-Southwark Corp.
Bastian-Blessing Co.
Bellfield Co.
Bookel & Co.
Boylston Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Builders Iron Foundry
Cash Co.

CONTROLLERS, Automatic, Pressure (Cont'd)
Connelly Iron Sponge Co.
Consol. Ashcroft-Hancock
Cutler-Hammer, Inc.
Davis Reg. Co.
D'Este Co.
Dockson Co.
Eclipse Fuel Engg.
Emerson Apparatus Co.
Fisher Governor Co.
Ford Reg. Valve Co.
Foster Engg. Co.
Foxboro Co.
Friez & Sons
Furnas Electric Co.
Gas Appl. Specialties
General Controls Co.
General Regulator Corp.
Gen. Sales & Prod.
Hanlon-Waters, Inc.
Hays Corp.
Hoke, Inc.
Hydraulic Press Co.
Industrial Inst. Co.
Klipfel Mfg. Co.
Lammert & Mann Co.
Leeds & Northrup Co.
Leslie Co.
Mason-Neilan Regulator
McDonnell & Miller
Mercoid Corp.
Mercon Regulator Co.
Natural Gas Equip. Inc.
Northern Equip. Co.
Penn Electric Switch
Perfex Corp.
Powers Regulator Co.
Precision Therm. & Inst.
Ranco Inc.
Republic Flow Meters

CONTROLLERS, Automatic, Pressure (Cont'd)
Reynolds Gas Regulator
Robertshaw Thermostat
Ruggles-Klingemann
Southwestern Electronics
Schade Valve Mfg. Co.
Scientific Inst. Co.
Spence Engineering Co.
Spencer Thermostat Co.
Sterling Eng. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thrush & Co., H. A.
Uehling Instrument Co.
Vapor Recovery Systems
Vaughn-G. E. Witt Co.
Victor Equipment Co.
Ward Leonard Elec. Co.
Water Level Controls Co.
Watts Regulator Co.
Wheelco Inst. Co.
White-Rodgers Electric
Wilgus Mfg. Co.

CONTROLLERS, AUTOMATIC, Pyrometric
Am. Gas Furnace Co.
Askania Regulator Co.
Automatic Temp. Control
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Burling Inst. Co.
Dickson Co.
Electronic Lab.
Electronic Prod. Co.
Engelhard, Chas.
Firmer Co.
Foxboro Co.
General Elec. Co.
G-M Labs
Hagan Corp.
Hoskins Mfg. Co.
Ill. Testing Labs.
Industrial Instrument Co.
Leeds & Northrup Co.
Lewis Engg. Co.
Lindberg Eng. Co.
Mason-Neilan Regulator
Partlow Corp.
Pyrometer Instrument Co.
R-S Products Corp.
Southwestern Electronics Labs.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thwing-Albert Instrument
Uehling Instrument Co.
Wheelco Inst. Co.

CONTROLLERS, AUTOMATIC, Radio Remote
Am. Automatic Electric
Guardian Elec. Mfg. Co.
RCA Manufacturing Co.
United Cinephone Corp.

CONTROLLERS, AUTOMATIC, Rate-Volume
Askania Regulator Co.
Brown Inst. Co.
Cash Co.
Fischer & Porter
Foxboro Co.
Hagan Corp.
Hanlon-Waters, Inc.
Taylor Inst. Cos.

CONTROLLERS, AUTOMATIC, Refrigeration
Allen-Bradley Co.
Brown Inst. Co.
Cash Co.
Cutler-Hammer, Inc.
D'Este Co.
Detroit Lubricator Co.
Dickson Co.
Electrimatic Corp.
Frick Co.
Fulton Sylphon Co.
General Controls Co.
Illinois Engr. Co.
Lumenite Elec. Co.
Mason-Neilan Regulator
Mercoid Corp.
Penn Electric Switch
Perfex Corp.
Phila. Thermometer Co.
Sarco Co., Inc.
Schade Valve Mfg. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
White-Rodgers Electric

CONTROLLERS, AUTOMATIC, RKVA (See Regulators)

CONTROLLERS, AUTOMATIC, Specific Gravity (See Controllers, Automatic, Gravity)

CONTROLLERS, AUTOMATIC, Speed (See Tachometric below)

CONTROLLERS, AUTOMATIC, Stoker (See Controllers, Automatic, Furnace)

CONTROLLERS, AUTOMATIC, Strain-Rate & Stress-Rate
Baldwin-Southwark Corp.

CONTROLLERS, AUTOMATIC, Synchronizing (See Regulators)

CONTROLLERS, AUTOMATIC, Tachrometric
Askania Regulator Co.
Bailey Meter Co.
Barbour-Stockwell Co.
Brown Inst. Co.
Cutler-Hammer, Inc.
Foxboro Co.
General Regulator Corp.
Mason-Neilan Regulator
Monitor Controller Co.
Republic Flow Meters

CONTROLLERS, AUTOMATIC, Temperature (See Pyrometric above or Thermometric below)

CONTROLLERS, AUTOMATIC, Temperature-Time (See Controllers, Automatic Thermometric; Controllers, Automatic, Thermostatic; Controllers, Automatic, Time)

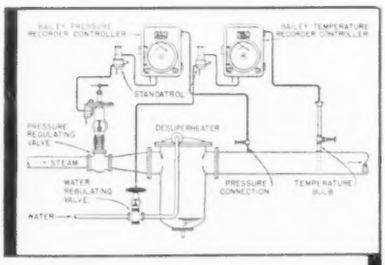
CONTROLLERS, AUTOMATIC, Thermometric
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Burling Inst. Co.
Consol. Ashcroft-Hancock
Dickson Co.
Edison Electrical Controls
Electrimatic Corp.
Electro-Medical Lab.
Electronic Control Corp.
Emerson Apparatus Co.
Fish-Schurman Co.
Foxboro Co.
Friez & Sons
General Elec. Co.
General Regulator Corp.
Walter J. Halpern
H-B Inst. Co., Inc.
Ill. Testing Labs.
Lindberg Eng. Co.
Moeller Instrument Co.
Paragon Electric Co.
Parks-Cramer Co.
Partlow Corp.
Precision Therm. & Inst.
Scientific Inst. Co.
Southwestern Electronics
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Wheelco Inst. Co.

CONTROLLERS, AUTOMATIC, Thermostatic
Accuracy Scientific Inst.
Allen-Bradley Co.
American Inst. Co.
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Barber-Coleman Co.
Bookel & Co.
Bristol Co.
Boiler Room Equip.
Brown Inst. Co.
Burling Inst. Co.
Bushnell, R. O.
Cook Electric Co.
Cramer & Co., Inc.
D'Este Co.
Detroit Lubricator Co.
Dickson Co.
Edison Electrical Controls
Electronic Control Corp.
Ernstat Co.
Fenwal, Inc.

CONTROLLERS, Automatic, Thermostatic (Cont'd)
Fish-Schurman Co.
Friez & Sons
Foster Eng. Co.
Fulton Sylphon Co.
General Controls Co.
General Elec. Co.
Gleason-Avery, Inc.
H-B Inst. Co.
Halpern, Walter J.
Illinois Engr. Co.
Industrial Engr. Corp.
Johnson Service Co.
Kiely & Mueller
Klipfel Mfg. Co.
Leslie Co.
McCorkle Co.
Mercoid Corp.
Partlow Corp.
Penn Electric Switch
Perfex Corp.
Phila. Thermometer Co.
Powers Regulator Co.
Precision Therm. & Inst.
Ranco Inc.
Rascher & Betzold
Robertshaw Thermostat
Ruggles-Klingemann
Sarco Co., Inc.
Southwestern Electronics
Spence Engineering Co.
Spencer Thermostat Co.
Sterling Eng. Co.
Struthers-Dunn
Tagliabue Mfg. Co.
Thrush & Co., H. A.
Trane Co.
Vaughn G. E. Witt Co.
Weston Elec. Inst. Corp.
White Mfg. Co.
White-Rodgers Elec. Co.

CONTROLLERS, AUTOMATIC, Time
Allen-Bradley Co.
Am. Gas Accumulator
Automatic Elec. Mfg. Co.
Automatic Temp. Control
Bailey Meter Co.
Bristol Co.
Consol. Ashcroft-Hancock
Cramer & Co., Inc.
Eagle Signal Corp.
Elec. Switch Corp.
Foxboro Co.
General Elec. Co.
Halpern, Walter J.
Hanlon-Waters, Inc.
Industrial Instrument Co.
Johnson Service Co.
Luxtrol Co., Inc.
Magnetic Gauge Co.
Mason-Neilan Regulator
Monitor Controller Co.
Paragon Electric Co.
Penn Electric Switch
Powers Regulator Co.
Stromberg Electric Co.
Struthers Dunn
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thomas Clock Co., Seth
Thrush & Co., H. A.
United Cinephone Corp.
Warren Telechron Co.
Zenith Electric Co.

CONTROLLERS, AUTOMATIC, Vacuum
Allen-Bradley Co.
Area Regulators, Inc.
Askania Regulator Co.
Bailey Meter Co.
(Continued on next page)



DESUPERHEATING & PRESSURE REDUCING CONTROL

● Bailey Meter Control of desuperheating and pressure reducing incorporates standard Bailey Recorder-Controllers for both pressure and temperature, as well as a special Bailey Reducing Valve equipped with valve positioner and air cooled packing gland.

The control system is air-operated and is arranged to maintain the desired final steam temperature by controlling the quantity of water fed to a cartridge type desuperheater. This temperature is measured by a sensitive bare bulb temperature recorder-controller with the temperature bulb located at the ● outlet of the desuperheater.

BAILEY METER COMPANY
1041 IVANHOE ROAD · CLEVELAND, O.
Bailey Meter Company Ltd., Montreal, Canada

TEMPERATURE SUPREMACY

CAPACITROL
Temperature Control

Actually 80% closer temperature control than the best mechanical instrument you can buy. There is no time lag between temperature deviation and control action. Closer control is not possible, yet CAPACITROL sells in the lower price ranges.

Wheelco catalog should be in your library—WRITE TODAY.

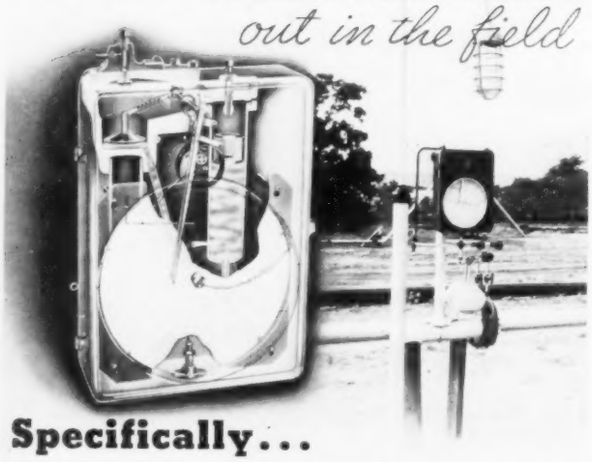
Wheelco Instruments Co.
1933 So. Halsted St. Chicago, Ill.

For addresses, see pages 54-58

Why

Low Maintenance

out in the field



Specifically...

Examine the rugged construction of Westcott orifice meters . . . selected materials . . . parts of forged or hardened stainless steel, special alloys . . . screw and welded connections. Note simplicity in design, facilities for easy adjustment . . . easy cleaning. The Westcott is a **PRACTICAL** engineering instrument. Complete literature available.

AMERICAN METER COMPANY

METRIC METAL WORKS *ERIE, PENNSYLVANIA*

CONTROLLERS, Automatic, Vacuum (Cont'd)
Boylston Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Cottrell Ashcroft Hancock
Cutler-Hammer, Inc.
Davis Reg. Co.
D'Este Co.
Detroit Lubricator Co.
Electronic Prod. Co.
Fisher Governor Co.
Foster Engg. Co.
Foxboro Co.
Fulton Sylphon Co.
Gas App. Specialties Co.
General Elec. Co.
Hanlon-Waters, Inc.
Illinois Engr. Co.
Klipfel Mfg. Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Natural Gas Equip. Inc.
Northern Equip. Co.
Penn Electric Switch Co.
Perfex Corp.
Powers Regulator Co.
Precision Therm. & Inst.
Schade Valve Mfg. Co.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Vaughn G. E. Witt Co.
White-Rodgers Electric
Wilgus Mfg. Co.

CONTROLLERS, AUTOMATIC, Valve (See Valve-Operating Devices)

CONTROLLERS, AUTOMATIC, Viscosity
Bailey Meter Co.
Foxboro Co.
General Elec. Co.
Green, Arthur R.
Scientific Inst. Co.
United Cinephone Corp.

CONTROLLERS, AUTOMATIC, Voltage (See Regulators)

CONTROLLERS, AUTOMATIC, Volume
Arca Regulators, Inc.
Askania Regulator Co.
Brown Inst. Co.
Cash Co.
Foxboro Co.
Hagan Corp.
Hanlon-Waters, Inc.
Mason-Neilan Regulator
United Cinephone Corp.

CONTROLLERS, MANUAL (Non-automatic), Field
Cutler-Hammer, Inc.
General Elec. Co.
Monitor Controller Co.
National Elec. Controller
Schaefer Bros. Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.

CONTROLLERS, MANUAL (Non-automatic) Motor
Allen-Bradley Co.
Cutler-Hammer, Inc.
Elec. Controller & Mfg.
Furnas Electric Co.
General Elec. Co.
Monitor Controller Co.
National Elec. Controller
Schaefer Bros. Co.
Southwestern Electronics
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.

CONTROLLERS, MANUAL (Non-automatic) Rheostatic
Allen-Bradley Co.
Allis-Chalmers Mfg. Co.
Cutler-Hammer, Inc.
Elec. Controller & Mfg.
General Elec. Co.
Monitor Controller Co.
National Elec. Controller
Ohmite Mfg. Co.
Rubicon Co.
Schaefer Bros. Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.

CONTROL SYSTEMS (See Controllers, Automatic)

COUNTERS, Alarm
Durant Mfg. Co.

COUNTERS, Cycle
Adde & Co.
Bristol Co.
General Elec. Co.
Industrial Inst. Co.
Paragon Electric Co.
Raytheon Mfg. Co.
Southwestern Electronics
Standard Elec. Time Co.
States Co.
United Cinephone Corp.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.

COUNTERS, Footage
Adde & Co.
Bristol Co.
Durant Mfg. Co.
Elec. Tachometer Corp.
McDonnell Odometer Co.

COUNTERS, Footage (Cont'd)
Ohmer Register Co.
Southwestern Electronics
United Cinephone Corp.
Veeder-Root, Inc.

COUNTERS, Hour
Cramer & Co., Inc.
Elec. Tachometer Corp.
General Elec. Co.
Ohmer Register Co.
Paragon Electric Co.
Southwestern Electronics
United Cinephone Corp.
Warren Telechron Co.
Westinghouse Elec. & Mfg.

COUNTERS, Lumber
Adde & Co.
Durant Mfg. Co.
Keuffel & Esser Co.
McDonnell Odometer Co.
Southwestern Electronics
Tally-Meter Co.

COUNTERS, Production
Adde & Co.
Bristol Co.
Cramer & Co., Inc.
Durant Mfg. Co.
Elec. Tachometer Corp.
Guardian Elec. Mfg. Co.
Hart Mfg. Co., R. E.
Luxtrol Co., Inc.
McDonnell Odometer Co.
Misener Mfg. Co.
Ohmer Register Co.
Photobell Corp.
Production Inst. Co.
Richardson Scale Co.
Southwestern Electronics
Struthers-Dunn
United Cinephone Corp.
Veeder-Root, Inc.

COUNTERS, Revolution
Adde & Co.
Bristol Co.
Boulin Instrument Corp.
Cummings Machine Wks.
Durant Mfg. Co.
Elec. Tachometer Corp.
Gurley, W. & L. E.
Hart Mfg. Co., R. E.
Ideal Commutator Dresser
Jaeger Watch Co.
Jones Motrola Sales Co.
Luxtrol Co., Inc.
Marsh Corp., Jas. P.
Mason-Neilan Regulator
McDonnell Odometer Co.
Misener Mfg. Co.
Ohmer Register Co.
Production Inst. Co.
George Scherr Co., Inc.
Southwestern Electronics

COUNTERS, Revolution (Cont'd)
Speidel & Co.
Standard Elec. Time Co.
Star Brass Mfg. Co.
Starrett Co., L. S.
Veeder-Root, Inc.
Warren-Knight Co.
Zernickow Co., O.

COUNTERS, Stroke
Adde & Co.
Bristol Co.
Durant Mfg. Co.
Eagle Signal Corp.
Guardian Elec. Mfg. Co.
Hart Mfg. Co., R. E.
International Register Co.
Luxtrol Co., Inc.
McDonnell Odometer Co.
Photobell Corp.
Ohmer Register Co.
Production Inst. Co.
Southwestern Electronics
United Cinephone Corp.
Veeder-Root, Inc.

COUNTERS, Twist
Boulin Instrument Corp.
Luxtrol Co., Inc.
McDonnell Odometer Co.
Roller-Smith Co.
Saxl Instrument Co.
Southwestern Electronics
Suter, Alfred

COURSE PROTRACTORS (See Protractors, Course)

CRYSTALS, Piezoelectric
Bliley Electric Co.
Bruesh Development Co.
General Radio Co.
Premier Crystal Labs.
RCA Manufacturing Co.
Valpey Crystals
Zeiss, Inc., Carl

CRYSTALS, Quartz
Bliley Electric Co.
Fuess, Inc.
General Radio Co.
Master Optical Co.
Premier Crystal Labs.
RCA Manufacturing Co.
Valpey Crystals

CRYSTALS, Rochelle Salt
Brush Development Co.

CRYSTALS, Tourmaline
Fuess, Inc.
Premier Crystal Labs.
Zeiss, Inc., Carl

CUBIC FOOT BOTTLES (See Bottles, Cubic Feet)

CURRENT LIMITERS
General Elec. Co.
Monitor Controller Co.

CURRENT METERS (See Meters, Current)

CURRENT REGULATORS (See Regulators, Current)

CURVE TRACERS (See Drawing Instruments)

CUTMETERS
Amthor Testing Inst. Co.
Coats Mach. Tool Co.
McDonnell Odometer Co.

CYCLE CONTROLLERS (See Controllers, Cycle)

CYCLE COUNTERS (See Counters, Cycle)

CYCLOMETERS
Veeder-Root, Inc.

CYLINDERS, GRADUATED (See Apparatus Laboratory, Glass)

DECELEROMETERS (See Accelerometers)

DECIBEL METERS (See Sound Level Meters)

DEEP SEA INSTRUMENTS
Ballauf Mfg. Co.

DEFLECTION TESTERS, Light Wave (See Testers, Deflection, Light Wave)

DEFORMETER
Baldwin-Southwark Corp.
Dietert Co.
Holz, Herman A.

DELINEASCOPES
Bausch & Lomb
Central Scientific Co.
Leitz, Inc.
Spencer Lens Co.

DEMAND, Indicators (See Meters, Demand, Electric; Meters, Demand, Gas)

DEMAND, Recorders
Bailey Meter Co.
Esterline-Angus Co.
General Elec. Co.
Lambert Meter Co.
Landis & Gyr, Inc.
Lincoln Meter Co.
Westinghouse Elec. & Mfg.

DEMAND — LIMITING METERS (See Meters, Demand Limiting)

DEMAND METERS (See Meters, Demand)

DEMAND TOTALIZING RELAYS & DEVICES (See Relays, Demand Totalizing)

DENSIMETERS
Akatos, Inc.
Natl. Aluminate Corp.
Pfaltz & Bauer, Inc.
Tagliabue Mfg. Co.

DENSOMETERS
Gaertner Scientific Corp.
Gurley, W. & L. E.
Tagliabue Mfg. Co.
Zeiss, Inc., Carl

DEPTH, Indicators, Length
Chicago Dial Ind. Co.
Federal Prod. Corp.
Starrett Co.

DEPTH, Indicators, Liquid
Bacharach Industrial Inst.
Bailey Meter Co.
Elec. Indicator Co.
Foxboro Co.
Geophysical Inst. Co.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Tagliabue Mfg. Co.
Uehling Instrument Co.

DEPTH, Recorders, Liquid
Bailey Meter Co.
Elec. Indicator Co.
Foxboro Co.
Geophysical Inst. Co.
Mason-Neilan Regulator
Tagliabue Mfg. Co.

DETECTOR CARS, For Testing Rails in Track
Sperry Products, Inc.

DETECTORS, Benzol
Mine Safety Appliances

DETECTORS, Carbon Monoxide
Mine Safety Appliances

DETECTORS, Hydrogen Cyanide
Mine Safety Appliances

DETECTORS, Hydrogen Sulphide
Mine Safety Appliances

DETECTORS, Mercury Vapor
Mine Safety Appliances

DETECTORS, Metal
Associated Research
General Elec. Co.
Geophysical Inst. Co.
Ill. Testing Labs.
Luxtrol Co., Inc.
McFarlin Co.
RCA Manufacturing Co.
Southwestern Electronics
United Cinephone Corp.

DETECTORS, Methane
Mine Safety Appliances

DETECTORS, Mine Gases
Bushnell, R. O.
Mine Safety Appliances
Southw'n Electronics Labs

DETECTORS, Potential
Littelfuse Labs.
Minerallac Electric Co.

DETECTORS, Radium
American Inst. Co.

DETECTORS, Voltage
Allen Elec. & Equip. Co.
General Elec. Co.
Gen. Physical Laboratory
Ideal Commutator Dresser
Meter Devices Co.
Minerallac Electric Co.

DIAL INDICATORS (Length)
Ames Co., B. C.
Brown & Sharpe
Chicago Dial Ind. Co.
Federal Prod. Corp.
Premier Crystal Labs.
Scientific Inst. Co.
Starrett Co.

DIAL MICROMETERS (See Micrometers, Dial)

DIFFERENTIAL PRESSURE (See Controllers, Gages, etc., Pressure)

DIFFRACTION GRATING (See Grating, Diffraction)

DILATOMETERS
American Inst. Co.
Dietert Co.
Ferner Co.
Gaertner Scientific Corp.
E. Leitz, Inc.
Rockwell Co., Stanley P.
Zeiss, Inc., Carl

DIVIDERS, Voltage (Radio Frequency)
Andrew, Victor J.
General Elec. Co.
General Radio Co.
International Resistance
Muter Company
Ohmite Mfg. Co.
Sensitive Research Inst.
Shalleross Mfg. Co.
Ward Leonard Elec. Co.

DIVIDING HEAD, OPTICAL
Zeiss, Inc., Carl

DIVIDING MACHINES
American Askania Corp.
Brown & Sharpe
Gaertner Scientific Corp.
Hayes Scientific Apps.
Holz, Herman A.
Mico Instrument Co.
Precise Instrument Co.

DRAFT, Indicators (See Gages, Draft) **Recorders** (See Gages, Draft)

DRAWING INSTRUMENTS
Alpha Instrument Co.
Altender & Sons
Dietzen Co.
Gurley, W. & L. E.
Henschel & Co.
Kern Co.
Keuffel & Esser Co.
Millers Falls Co.
Post Co., Frederick
Soltmann, Inc., E. G.
Speidel & Co.
Starrett Co., L. S.
Union Tool Co.
United States Blue Print
Warren-Knight Co.
Weber Co., F.
White Co., Inc., David

DRIFT INDICATORS
Driftmeters, Inc.
Gurley, W. & L. E.
Kollmorgen Optical Co.
Kollsman Inst. Co.
Pioneer Instrument Co.

DRIFT INDICATORS, Bore Hole
Sperry-Sun Well Surveying

DUROMETERS (See Testers & Testing Machines, Hardness)

DUST ANALYSIS APPARATUS
Bausch & Lomb Optical
Central Scientific Co.
Corning Glass Works
Eimer & Amend
Falstrom Co.
Federal Pneumatic Systems
Fisher Scientific Co.
Macalaster Bicknell Co.
Mine Safety Appliances
Pfaltz & Bauer, Inc.
Sargent & Co.
Scientific Glass Apparatus
Scientific Inst. Co.
Southwestern Electronics
Willson Products, Inc.
Zeiss, Inc., Carl

DYNAMOMETERS, Hydraulic
Taylor Mfg. Corp.

DYNAMOMETERS, Pull Rod
Hayes Scientific Apps.
Martin Decker Corp.
Seederer-Kohlbusch, Inc.

DYNAMOMETERS, Rotary Absorption
Bristol Co.
General Elec. Co.
L. A. B. Corp.

DYNAMOMETERS, Tension
Baldwin-Southwark Corp.
Boulin Instrument Corp.
Holz, Herman A.
Olsen Testing Machine
Riehle Div.
Seederer-Kohlbusch

DYNAMOMETERS, Torsion
Holz, Herman A.

DYNAMOMETERS, Transmission
Holz, Herman A.
Seederer-Kohlbusch

DYNAMOMETER CARS, Railway
Holz, Herman A.

For addresses, see pages 54-58

EARTH CURRENT METERS (See Meters, Earth Current)

EARTH RESISTANCE METERS
American Inst. Co.
Biddle Co., Jas. G.
Geophysical Inst. Co.
Industrial Insts. Inc.
Rawson Electrical Inst.
Rubicon Co.
Southwestern Electronics
Sticht & Co.

EBULLIOMETERS
American Inst. Co.
Braun Corp.
Central Scientific Co.
Elmer & Amend
Precision Therm. & Inst.
Rascher & Betzold
Tagliabue Mfg. Co.

EBULLISCOPE (See Ebulliometers)

ECHELON GRATING (See Grating, Echelon)

ELECTRIC WAVE FILTER SECTIONS
Andrew, Victor J.
Bliley Electric Co.
Clough-Brengle Co.
General Radio Co.
United Transformer Corp.

ELECTROMETERS, Quadrant
Cambridge Inst. Co.
Central Scientific Co.
Pfaltz & Bauer, Inc.
Precise Instrument Co.
Rubicon Co.
Testrite Instrument Co.
Welch Mfg. Co.

ELECTROMETERS, String
Cambridge Inst. Co.
Geophysical Inst. Co.
Pfaltz & Bauer, Inc.

ELECTRONIC METERS (See Meters, Electronic)

ELECTROPLATING SOLUTION TESTING APPARATUS
Central Scientific Co.
Fisher Scientific Co.
Hellige, Inc.
Industrial Insts. Inc.
Pfaltz & Bauer, Inc.
Sargent & Co.
Taylor & Co., Inc., W. A.
Thwing-Albert Inst. Co.

ELECTROSCOPES
Chicago Apparatus Co.
Denver Fire Clay Co.
Geophysical Inst. Co.
Pfaltz & Bauer, Inc.
Southwestern Electronics

ELLIPSOGRAPHS (See Drawing Instruments)

END MEASURES
Pratt & Whitney

ENGINE INDICATORS (See Indicators, Engine)

ENGINE INDICATOR REDUCING MOTION (See Reducing Motion, Engine Indicator)

EUDIOMETERS
Ace Glass Inc.
Central Scientific Co.
Elmer & Amend
Machlett & Son

EUSCOPES
Bausch & Lomb Optical

EXPANSION TEST APPARATUS (See Testers, Expansion)

EXTENSOMETERS
American Inst. Co.
Baldwin-Southwark Corp.
Cambridge Inst. Co.
Ferner Co.
Hayes Scientific Apps.
Holz, Herman A.
Olsen Testing Machine

EYEGLASSES, POLARIZED (for Photoelastic Work or Strain Observation, etc.)
Polarizing Inst. Co.
Zeiss, Inc., Carl

FADE-OMETER
American Inst. Co.
Atlas Elec. Devices Co.
Central Scientific Co.
Pfaltz & Bauer, Inc.
Gen. Elec. Vapor Lamp
Saxl Inst. Co.

FAULT LOCATORS
Industrial Insts. Inc.
Leeds & Northrup
Rawson Elec. Inst. Co.
Rubicon Co.
Shallcross Mfg. Co.
Tobe Deutschmann Corp.

FEED WATER METERS
Bailey Meter Co.
Brown Inst. Co.
Builders Iron Foundry
Central Station Steam
Cochrane Corp.
Elec. Indicator Co.
Fischer & Porter
Henszey Co.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Republic Flow Meters
Tagliabue Mfg. Co.

FEED WATER TESTING APPARATUS
Allis-Chalmers Mfg. Co.
Central Scientific Co.
Cochrane Corp.
Electronic Products Co.
Elgin Softener Corp.
G. M. Mfg. Co., Inc.
Hellige, Inc.
Industrial Insts. Inc.
LaMotte Chemical Prod.
Leeds & Northrup Co.
Pfaltz & Bauer, Inc.
Taylor & Co., Inc., W. A.

FIELD RHEOSTATS (See Rheostats, Field)

FIELD-STRENGTH MEASURING SETS
Andrew, Victor J.
Ferris Inst. Corp.
McFarlin Co.
RCA Manufacturing Co.
Tobe Deutschmann Corp.

FILLING MACHINES, Automatic
Anderson Bros. Mfg. Co.
Bowser & Co.
Gump Co., B. F.
Richardson Scale Co.
Syntron Company
Triangle Package Mach.

FILLING MACHINES, Bag
Gump Co., B. F.
Richardson Scale Co.
Syntron Company
Triangle Package Mach.

FILLING MACHINES, Barrel
Bowser & Co.

FILLING MACHINES, Can
Anderson Bros. Mfg.
Bowser & Co.
Gump Co., B. F.
Triangle Package Mach.

FILLING MACHINES, Carton
Gump Co., B. F.
Triangle Package Mach.

FILTERS, Light (See also Filters, Optical)
American Inst. Co.
Baird Associates
Black-Ray Lighting Co.
Central Scientific Co.
Corning Glass Works
Fish-Schurman Co.
Fuess, Inc.
Kollmorgen Optical Co.
Leitz, Inc.
Perkin, Elmer & Moffitt
Zeiss, Inc., Carl

FILTERS, Optical
Akatos, Inc.
Bausch & Lomb Optical
Fecker, J. W.
General Scientific Corp.
Goerz Amer. Optical Co.
Klett Mfg. Co.
Mico Instrument Co.
Pfaltz & Bauer, Inc.
Testrite Instrument Co.
Triumph Mfg. Co.
United Cinephone Corp.

FINDEPS, VALVE BOX
Geophysical Inst. Co.

FIRE CONTROL INSTRUMENTS, MILITARY & NAVAL
Elec. Indicator Co.
Fecker, J. W.
Kern Co.
Kollmorgen Optical Co.
United Cinephone Corp.

FIRING DISKS
Veritas Firing System

FLASH POINT TESTERS (See Testers, Flash Point)

FLASHERS, Neon Tube
Automatic Elec. Mfg. Co.
Bacharach Industr al Inst.
Paragon Electric Co.
Sangamo Electric Co.

FLATNESS TESTERS (See Testers, Flatness, Light Wave)

FLATS, OPTICAL
Am. Telescope Labs.
Baird Associates
Bausch & Lomb Optical
Clark & Sons
Fecker, J. W.
Ferner Co.
Fish-Schurman Co.
Fuess, Inc.
Gaertner Scientific Corp.
Goerz Amer. Optical Co.

FLATS, OPTICAL (Cont'd)
Kollmorgen Optical Co.
Master Optical Co.
Mico Instrument Co.
Perkin, Elmer & Moffitt
Scherr Co., Inc., George
Van Keuren Co.
Zeiss, Inc., Carl

FLATS, OPTICAL, Fused Quartz
Thermal Syndicate Ltd.

FLOWMETERS, Air
Am. Gas Furnace Co.
American Inst. Co.
American Meter Co.
Bacharach Industrial Inst.
Bailey Meter Co.
Binckley, G. S.
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Clark Blast Meter
Cochrane Corp.
Commercial Engg. Labs.
Detroit Air Meter Co.
Fischer & Porter

FLOWMETERS, AIR (Cont'd)
Fish-Schurman Co.
Foxboro Co.
Friez & Sons
Henszey Co.
Ill. Testing Labs.
Jensen Inst. Co.
Lambert Meter Co.
Mason-Neilan Regulator
Meriam Co.
Morey & Jones, Ltd.
New Jersey Meter Co.
Republic Flow Meters
Schutte & Koerting Co.
Scientific Glass Apparatus
Selas Company
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Victor Equipment Co.

FLOWMETERS, Area, Cone & Disk Type
Fischer & Porter
National Meter Co.

FLOWMETERS, Area, Cylinder & Piston Type
American Inst. Co.
Bowser & Co.

FLOWMETERS, AREA Cylinder & Piston Type (Cont'd)
Brown Inst. Co.
Fischer & Porter
National Meter Co.
New Jersey Meter Co.

FLOWMETERS, Area, Free Float Type
Am. Gas Furnace Co.
D'Este Co.
Fischer & Porter
Hoke, Inc.
Schutte & Koerting Co.

FLOWMETERS, Area, Orifice & Plug Type
American Meter Co.
Bacharach Industrial Inst.
Brown Inst. Co.
Cochrane Corp.
Fischer & Porter
Mason-Neilan Regulator
Republic Flow Meters

FLOWMETERS, Blast
Bacharach Industrial Inst.
Bailey Meter Co.
Brown Inst. Co.
Clark Blast Meter

FLOWMETERS, Blast (Cont'd)
Cochrane Corp.
Tagliabue Mfg. Co.

FLOWMETERS, Gas, Indicating
American Meter Co.
Bacharach Industrial Inst.
Bailey Meter Co.
Binckley, G. S.
Bowser & Co.
Bristol Co.
Brown Inst. Co.
Cochrane Corp.
Commercial Engg. Labs.
D'Este Co.
Detroit Air Meter Co.
Eclipse Aviation
Elec. Indicator Corp.
Fischer & Porter
Fish-Schurman Co.
Foxboro Co.
Friez & Sons
Gas Appliance Specialties
Henszey Co.
Hoke, Inc.
International Filter Co.

(Continued on next page)

For accurate measurement and control of

FLOW AND LIQUID LEVEL

IF YOU require instruments for indicating or controlling flow or liquid level, Taylor can serve you. The three types shown at right are examples of the complete line of Taylor Instruments available.

TAYLOR DIAL-TYPE FLOW INDICATORS. for liquids, or for gases or steam under constant pressure, are ideal where only momentary indication of rate of flow is required.

TAYLOR FLOW RECORDERS come in single-pen and two- and three-pen types. The single-pen type records rate of flow directly when square root charts are used, or differential pressure when uniformly graduated charts are used. It also measures gases and steam which are under constant pressure, or where the pressure is assumed to be constant. Two-pen and three-pen types for gases and steam are generally furnished with uniformly graduated charts having two scales—one for differential pressure and one for static pressure or temperature.

TAYLOR FULSCOPE FLOW CONTROLLERS offer many full-range sliding adjustments. Their identity in mechanism with Fulscope Temperature and Pressure Controllers makes it possible to standardize on one basic control mechanism.

TAYLOR LIQUID LEVEL INDICATORS. made in differential pressure and static pressure types, have silvered-metal dials with bold figures and graduations.

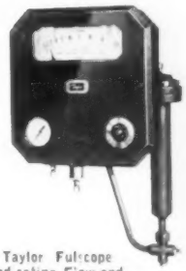
TAYLOR FULSCOPE LIQUID LEVEL CONTROLLERS are available in differential pressure, static pressure and internal and external float types.

TAYLOR LIQUID LEVEL RECORDERS are made in differential pressure types, applicable to either open or closed vessels, provided differential pressure is less than 200" of water, or the equivalent in other units of measurement. Special manometers can be supplied for greater ranges.

For full information, get in touch with the Taylor Representative or write for catalog, Taylor Instrument Companies, Rochester, New York. Plant also in Toronto, Canada.

Taylor Fulscope Recording Flow and Liquid Level Controller

Taylor Round Dial Flow Indicator



Taylor Fulscope Indicating Flow and Liquid Level Controller

Taylor

indicating · Recording · Controlling

TEMPERATURE, PRESSURE, FLOW *and* **LEVEL INSTRUMENTS**

For addresses, see pages 54-58

FLOW METERS

COMPACT, simplified flow meters of various types for accurately indicating, recording and totalizing fluid flow. For use with such primary devices as orifices, venturi tubes, pitot tubes, or venturi flumes and weirs.

Let us help solve your flow metering problems

Morey & Jones, Ltd.

Manufacturing Engineers

922 So. Hemlock St., Los Angeles, Calif.

BAILEY

Fluid Meters

For STEAM · LIQUIDS · GASES

● Bailey Fluid Meters are designed to indicate, record and integrate the flow of steam, liquids, or gases under practically any pressure or temperature condition.

A great variety of indicating, recording and integrating combinations are available for use with four distinct types of flow mechanisms.

This large variety of possible combinations enables the flow meter engineer to specify equipment which is pre-eminently suited to any flow measuring application.

When it is desired to place indicators, recorders and integrators at a considerable distance from the primary element, Bailey Synchro-Meters are available to provide electric transmission.

For detailed information consult Sweet's Engineering Catalogs or request a copy of bulletin No. 301.

BAILEY METER COMPANY

1041 IVANHOE ROAD · CLEVELAND, O.

Bailey Meter Company Ltd., Montreal, Canada

FLOWMETERS, Gas, Indicating (Cont'd)
Jensen Inst. Co.
Kollsman Inst. Co.
Lambert Meter Co.
Leeds & Northrup
Leupold, Voigtel & Co.
Mason-Neilan Regulator
Meriam Co.
Morey & Jones, Ltd.
National Meter Co.
New Jersey Meter Co.
Republic Flow Meters
Schutte & Koerting Co.
Selas Company
Sprague, Inc.
Tagliabue Mfg. Co.
Taylor Inst. Cos.

FLOWMETERS, Gas, Indicating & Recording (See Flow Meters, Gas, Indicating)

FLOWMETERS, Gas, Integrating & Recording (See Flow Meters, Gas, Indicating)

FLOWMETERS, Gas, Ring Balance
Cochrane Corp.

FLOWMETERS, Liquid (See Flow Meters, Gas, Indicating)

FLOWMETERS, Nozzle
Askania Regulator Co.
Bacharach Industrial Inst.
Bailey Meter Co.
Binckley, G. S.
Brown Inst. Co.
Cochrane Corp.
Foxboro Co.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Republic Flow Meters
Taylor Inst. Cos.

FLOWMETERS, Open-Stream
Bristol Co.
Cochrane Corp.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Scientific Inst. Co. Calif.

FLOWMETERS, Orifice
Ace Glass Inc.
American Meter Co.
Askania Regulator Co.
Bacharach Industrial Inst.
Bailey Meter Co.
Binckley, G. S.
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Cochrane Corp.
Eimer & Amend
Foxboro Co.
Hoke, Inc.
Jensen Inst. Co.
Lambert Meter Co., Inc.
Leeds & Northrup Co.
Mason-Neilan Regulator
Meriam Co.
Morey & Jones, Ltd.
Pgh. Equitable Meter
Republic Flow Meters
Scientific Glass Apparatus
Tagliabue Mfg. Co.
Taylor Inst. Cos.

FLOWMETERS, Pitot Tube
Am. Blower Corp.
American Meter Co.
Askania Regulator Co.
Bacharach Industrial Inst.
Binckley, G. S.
Brown Inst. Co.
Builders Iron Foundry
Cambridge Inst. Co.
Central Scientific Co.
Cochrane Corp.
Defender Automatic Reg.
Detroit Air Meter Co.
Foxboro Co.
Friez & Sons
Fuess, Inc.
Kollsman Inst. Co.
Meriam Co.
Morey & Jones, Ltd.
Pitometer Log Corp.
Precision Therm. & Inst.
Refinery Supply Co.
Republic Flow Meters
Taylor Inst. Cos.

FLOWMETERS, Steam
Am. Dist. Steam Co.
American Meter Co.
Bailey Meter Co.
Binckley, G. S.
Bristol Co.
Brown Inst. Co.
Cochrane Corp.
Foxboro Co.
Jensen Inst. Co.
Leeds & Northrup Co.
Mason-Neilan Regulator
Meriam Co.
Morey & Jones, Ltd.
Republic Flow Meters
Tagliabue Mfg. Co.
Taylor Inst. Cos.

FLOWMETERS, Vane
Autocall Co.
Detroit Air Meter Co.
Ill. Testing Labs.

FLOWMETERS, Venturi
Bailey Meter Co.
Binckley, G. S.
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Cochrane Corp.
Foxboro Co.
International Filter Co.
Jensen Inst. Co.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Republic Flow Meters Co.
Taylor Inst. Cos.

FLOWMETERS, Weir
Bailey Meter Co.
Binckley, G. S.
Brown Inst. Co.
Cochrane Corp.
Elec. Indicator Corp.
Gurley, W. & L. E.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Taylor Inst. Cos.

FLUE GAS ANALYZERS (See Gas Analyzers, Flue Gas)

FLUID METER, GAS (See Gas Meters)

FLUID METERS, LIQUID (See Liquid Meters)

FLUID METERS, QUANTITY (See Meters, Current) (See Gas Meters) (See Liquid Meters)

FLUORESCENT CHEMICALS
Black-Ray Lighting Co.
Central Scientific Co.
Pfaltz & Bauer, Inc.
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FLUOROSCOPES
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General Elec. Co.
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Rawson Electrical Inst.
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FOLDING ENDURANCE TESTERS (PAPER) (See Testers, Folding Endurance)

FOOT BLOCKS
Ford Motor Co.

FOOT CANDLE METERS
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General Elec. Co.
G-M Labs.
Intercontinental Market.
Loewenberg, F.
Luxtrol Co., Inc.
Pfaltz & Bauer, Inc.
United Cinephone Corp.
Weston Elec. Inst. Corp.

FOREWARN DETECTOR for locating hidden weapons (See Detectors, Metal)

FORKS, Synchronization
Elec. Tachometer Corp.
Gaertner Scientific Corp
Riverbank Laboratories

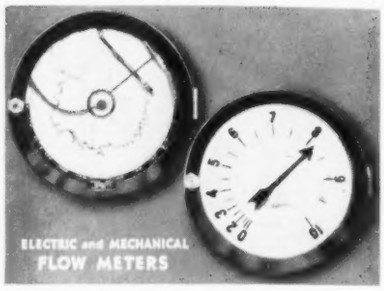
FORKS, Tuning
Clay-Adams Co.

FORKS, Tuning, Electrically Driven
Cambridge Inst. Co.
Central Scientific Co.
Chicago Apparatus Co.
Elec. Tachometer Corp.
Engineering Labs., Inc.
Gaertner Scientific Corp.
General Radio Co.
Riverbank Laboratories
Welch Mfg. Co.

FORKS, Vacuum Driven
Cambridge Inst. Co.
Gaertner Scientific Corp.
Riverbank Laboratories

FRACTIONAL HORSEPOWER MOTORS (See Motors, Fractional Horsepower)

FREENESS TESTERS (See Testers, Freeness)



For controlling, recording, totalizing and indicating the flow of fluids such as steam, water, gas, oil, etc.

Brown Flow Meters are available in two types, the Inductance Bridge Type (electric type) and Mechanical Type.

INDUCTANCE BRIDGE TYPE—Complete equipment consists of three units, the orifice plate, manometer and instrument. Instrument can be located at a remote point from the orifice and manometer (point of flow measurement).

Because of this flexibility, it is particularly adaptable for applications where instruments are to be remotely located for control purposes.

MECHANICAL TYPE—Complete equipment consists of two units, the orifice plate and the instrument. The meter body is integral with the instrument. Readings are transmitted mechanically from meter body to instrument.

Write for Catalog 2005. THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4482 Wayne Avenue, Philadelphia, Pa.

BROWN FLOW METERS
AND
MINNEAPOLIS-HONEYWELL CONTROL SYSTEMS
To Measure and Control is to Economize

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Distinguished for extreme accuracy and high quality, Cochrane flow Meters are reliable guides for compiling records of consumption, intake, output and variation in the rate of flow of steam, gases, water and other liquids. The Electric Model utilizes the galvanometer null principle.

ELECTRICAL MODEL

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The sensitive galvanometer detects the slightest change in rate of fluid flow, unaffected by friction or variations in voltage or frequency. Can be installed any distance from pipe line. The mechanical model develops an extremely high torque, is accurate in design, simple and rugged in construction.

ORIFICE METERS AND TYPE E WEIR METERS

—have the same Cochrane accuracy and simplicity and are highly regarded by users for their particular applications.

Write for Publication Nos. 2092, 2094, 2096

COCHRANE CORPORATION

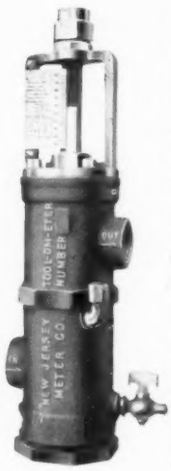
3120 N. 17th Street Philadelphia, Pa.

COCHRANE
FLOW METERS

For addresses, see pages 54-58

New Jersey Air Meters

TOOL-OM-ETER and DRILL-OM-ETER



Measure the flow of Compressed Air to any process or tool. Guide the maintenance of pneumatic equipment in effective working condition.

These meters are of the constant head, variable orifice type, simple, reliable, portable, only one moving part. Used on air and other gases at 1-300 lb.

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Autocall Co.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Commercial Eng. Labs.
Eclipse Aviation
Fischer & Porter
Foxboro Co.
Hagan Corp.
Mason-Neilan Regulator
National Airoil Burner
Taylor Inst. Cos.
Victor Equipment Co.

FURNACE CONTROL SYSTEMS (See Controllers, Automatic)

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Kewaunee Mfg. Co.
Kimball Co., W. W.
Laboratory Const. Co.
Laboratory Furniture Co.
Moline Furniture Works
Precise Instrument Co.
Sheldon & Co.
Sjostrom Co.
Southern Desk Co.
Welch Mfg. Co.

FUSES, INSTRUMENT
Littelfuse Labs.
Meter Devices Co.

GAGE BLOCKS
Ford Motor Co.
Pratt & Whitney
Van Keuren Co.

GAGE TESTERS, Dead-weight
American Inst. Co.
Amthor Testing Inst. Co.
Ashton Valve Co.
Consol. Ashcroft-Hancock
Crosby Steam Gage Co.
Holz, Herman A.
Olsen Testing Machine
Refinery Supply Co.
Star Brass Mfg. Co.

GAGE TESTERS, Fluid-scale
Crosby Steam Gage Co.

GAGE TESTERS, Liquid-column
Consol. Ashcroft-Hancock

GAGES (See also object of Measurement and control)

GAGES, Absolute Pressure
Bailey Meter Co.
Brinkley, G. S.
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft-Hancock
Emery Co.
Foxboro Co.
Kollsman Inst. Co.
Mason-Neilan Regulator
Moeller Instrument Co.
Precision Therm. & Inst.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Uehling Instrument Co.
Victor Equipment Co.

GAGES, Air
Ashton Valve Co.
Bailey Meter Co.
Bastian-Blessing Co.
Bristol Co.
Consol. Ashcroft-Hancock
Detroit Air Meter Co.
Foxboro Co.
Friez & Sons
Lambert Meter Co., Inc.
Marsh Corp.
Mason-Neilan Regulator
Rochester Mfg. Co.
Star Brass Mfg.
U. S. Gage Co.
Victor Equipment Co.

GAGES, Alarm
Ashton Valve Co.
Bailey Meter Co.
Bristol Co.
Consol. Ashcroft-Hancock
Crosby Steam Gage
Foxboro Co.
Marsh Corp.
Mason-Neilan Regulator
Precision Therm. & Inst.
Star Brass Mfg.
U. S. Gage Co.

GAGES, Amplifying
Coats Mach. Tool Co.
Comtor Co.
Federal Prod. Corp.
North Side Tool Co.
Precision Gage & Tool
Saxl Instr. Co.
United Cinephone Corp.

GAGES, Bore
Brown & Sharpe
Comtor Co.
Federal Prod. Corp.
Pratt & Whitney
Scherr Co.
Sheffield Gage

GAGES, Bourdon
Ashton Valve Co.
Bailey Meter Co.
Baldwin-Southwark Corp.
Bastian-Blessing Co.
Bellfield Co.
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft-Hancock
Crosby Steam Gage
Dickson Co.
Emery Co.
Foxboro Co.
Hays Corp.
Hoke, Inc.
Improved Gauge Mfg.
Mason-Neilan Regulator
Merewid Corp.
Republic Flow Meters
Star Brass Mfg. Co.
Taylor Inst. Cos.

GAGES, Caliper (Dial)
Brown & Sharpe
Federal Prod. Corp.
Gleason & Co.
Starrett Co.

GAGES, Center
Millers Falls Co.
Starrett Co.
Union Tool Co.

GAGES, Comparator
Ames Co., B. C.
Coats Mach. Tool Co.
Comtor Co.
Federal Prod. Corp.
Gaertner Scientific Corp.
Jones & Lamson Machine
North Side Tool Co.
Pratt & Whitney
Precision Gage & Tool
Saxl Inst. Co.
Scherr Co.
Sheffield Gage
United Cinephone Corp.

GAGES, Compression
Allen Elec. & Equip.
Bacharach Indus. Inst.
Saxl Inst. Co.
Riehle Div.
Toledo Scale Co.

GAGES, Cylinder
Ames Co., B. C.
Coats Mach. Tool Co.
Comtor Co.
Federal Prod. Corp.
Pratt & Whitney
Starrett Co.
United Cinephone
Victor Equipment

Foxboro offers a complete line of Flow Meters for measuring steam, gas, air, oil, water, acids and other fluids. These meters are of the orifice type—simple in design, powerful, with a straight-line motion that assures permanent calibration and long life. They can be furnished with direct-reading integrator to give total flow. Recorders may also be equipped with pressure, temperature and integrator pens.

For complete information write for Bulletin No. 200-2 and Bulletin 692. The Foxboro Company, 46 Neponset Avenue, Foxboro, Mass., U.S.A. Branch offices in 25 Principal Cities.

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The HAYS CORPORATION
COMBUSTION INSTRUMENTS AND CONTROLS
MICHIGAN CITY, INDIANA, U.S.A.

For addresses, see pages 54-58

The Foxboro line includes Indicators, Recorders and Controllers in a variety of types to satisfy every condition which may be encountered. Liquids in both open and closed pressure vessels can be measured and controlled accurately.

Whatever your problem may be you will find a Foxboro Liquid Level Gauge exactly suited to your requirements. For complete information write for Bulletin No. 187. The Foxboro Company, 46 Neponset Avenue, Foxboro, Mass., U. S. A. Branch offices in 25 Principal Cities.

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DIAL INDICATORS

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One of over 60 different Dial Indicators

Most complete line available, graduated from .0˜0025" to .005". Five sizes. FEDERAL Indicators are exceptionally accurate and durable.

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Ames Co., B. C.
Brown & Sharpe
Glogan & Co.
Pratt & Whitney
Starrett Co.
Union Tool Co.

GAGES, Depth, Navigational
Geophysical Inst. Co.

GAGES, Dial, Machinists'
Ames Co., B. C.
Brown & Sharpe
Chicago Dial Ind.
Federal Prod. Corp.
Ferner Co.
Genales, Andrew
Randall, Frank E.
Starrett Co.
Waltham Dial Gage

GAGES, Differential Pressure
American Meter Co.
Bacharach Industrial Inst.
Bailey Meter Co.
Binckley, G. S.
Boiler Room Equip.
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft Hancock
Crew Equip. Co.
Crosby Steam Gage
Defender Automatic Reg.
Detroit Air Meter Co.
Dwyer Mfg. Co.
Ellison Draft Gage Co.
Foxboro Co.
Friez & Sons
Fuess, Inc.
Gas Appliance Specialties
Hays Corp.
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Lambert Meter Co.
Mason-Neilan Regulator
Meriam Co.
Moeller Instrument
Morey & Jones, Ltd.
Pitometer Log Corp.
Precision Therm. & Inst.
Preferred Utilities Mfg.
Republic Flow Meters
Scientific Glass Apparatus
Scientific Inst. Co.
Tagliabue Mfg. Co.
Tay'or Inst. Co.
Uehling Instrument Co.
U. S. Gage Co.

GAGES, Draft (See Gages, Differential Pressure)

GAGES, Drill Grinding
Morse Twist Drill
Starrett Co.

GAGES, Feeler
Improved Gauge Mfg.
Millers Falls Co.
Starrett Co.
Union Tool Co.
Van Keuren Co.

GAGES, Gas
Abercrombie Pumn Co.
American Meter Co.
Bailey Meter Co.
Bastian-Blessing
Bristol Co.
Connel'y Iron Sponge
Detroit Air Meter
Dickson Co.
Foxboro Co.
Gas Appliance Specialties
Lambert Meter Co.
Linde Air Products
Mason-Neilan Regulator
Rochester Mfg. Co.
Specialty Glass Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Victor Equipment

GAGES, Grinding
Ames Co., B. C.
Brown & Sharpe
Comtor Co.
Federal Prod. Corp.

GAGES, Height
Brown & Sharpe
Ford Motor Co.
Scherr Co.
Starrett Co.

GAGES, Hook
Gurley, W. & L. E.
Scientific Inst. (Calif.)
White Co. Inc.

GAGES, Hydrostatic
Ashton Valve Co.
Bacharach Industrial Inst.
Crosby Steam Gage
King-Seeley Corp.
Liquidometer Co.
Mason-Neilan Regulator
Star Brass Mfg.
Tagliabue Mfg. Co.

GAGES, Internal Dial
Coats Mach. Tool
Comtor Co.
Federal Prod. Corp.
Scherr Co.

GAGES, Limit
Ford Motor Co.
General Elec. Co.
Greenfield Tap & Die
Meldrum Gabrielson
Pratt & Whitney
Sheffield Gage
United Cinephone
Van Keuren Co.

GAGES, Liquid Level, Indicating
American Meter Co.
Autocall Co.
Bacharach Industrial Inst.
Bailey Meter Co.
Bastian-Blessing
Binckley, G. S.
Bin-Dicator Co.
Boston Auto Gage
Bowser & Co.
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Burt Scientific Labs.
Cochrane Corp.
Consol. Asheroft Hancock
Crosby Steam Gage
Davis Reg. Co.
Defender Automatic Reg.
Dickson Co.
Elec. Indicator Corp.
Elec. Tachometer Corp.
Fisher Governor Co.
Foxboro Co.
Frick Co.
General Controls Co.
General Elec. Co.
Gurley, W. & L. E.
Hanlon-Waters, Inc.
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Jensen Inst. Co.
Jerguson Gage Co.
Johnston & Jennings
Kellogg Switchboard
King-Seeley
Klingerit, Inc.
Leeds & Northrup Co.
Leupold, Volpel
Liquidometer Co.
Lumenite Elec. Co.
Luxtrol Co., Inc.
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Meriam Co., The
Morey & Jones, Ltd.
Nathan Mfg. Co.
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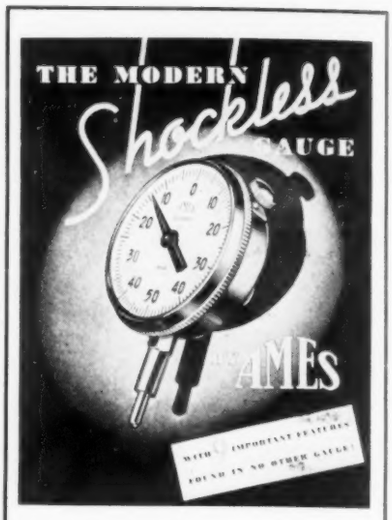
Paragon Electric
Penberthy Injector Co.
Petrometer Corp.
Pioneer Instrument Co.
Pneumercator Co., Inc.
Precision Therm. & Inst.
Preferred Utilities Mfg.
Reliance Gauge Column
Republic Flow Meters
Rochester Mfg. Co.
Schutte & Koerting Co.
Southw'n Electronics Labs
Star Brass Mfg.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Uehling Instrument Co.
Vapor Recovery Systems
Wallace & Tiernan
Westinghouse Elec. & Mfg.
Wheelco Inst. Co.
Williams Gauge Co.
Yarnell-Waring Co.

GAGES, Liquid Level, Recording (See Gages, Liquid Level, Indicating)

GAGES, Loss of Head
Bailey Meter Co.
Binckley, G. S.
Bristol Co.
Builders Iron Foundry
Foxboro Co.
International Filter Co.
Jensen Inst. Co.
Morey & Jones, Ltd.
Taylor Inst. Cos.

GAGES, Mercury
Bacharach Industrial Inst.
Bailey Meter Co.
Builders Iron Foundry
Central Scientific
Connelly Iron Sponge
Consol. Ashcroft Hancock
Defender Automatic Reg.
Dubrovin John
Dwyer Mfg. Co.
Eimer & Amend
Gas Appliance Specialties
General Physical Lab.
Jensen Inst. Co.
Machlett & Son
Mason-Neilan Regulator
Meriam Co.
Moeller Instrument
Morey & Jones
Precision Therm. & Inst.
Refinery Supp'y Co.
Scientific Glass Apparatus
Specialty Glass Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Uehling Instrument Co.

GAGES, Micrometer
Ames Co., B. C.
Brown & Sharpe
Central Scientific Co.
Coats Mach. Tool Co.
Gaertner Scientific Corp.
Haines Gauge Co.
Precision Therm. & Inst.
Scherr Co.
Van Keuren Co.
Millers Falls Co.
Zeiss, Inc., Carl

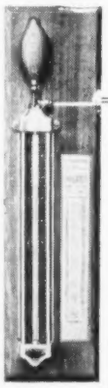


AMES Shockless Gauges

are steadily replacing less durable ones on measuring jobs where rough treatment is apt to damage the sensitive mechanisms. They accurately indicate the slightest size variations and have several other exclusive features besides the shock-absorber. Send for your copy of the bulletin describing them.

B. C. AMES COMPANY
WALTHAM, MASS.

TANK GAUGE



PETROMETER

PETROMETER is used for all kinds of liquids, lighter or heavier than water, stored in any type of tank or container made of steel, glass, hard rubber, concrete or other kinds of materials.

PETROMETER is an instrument for indicating at a remote location the depth of liquid in tanks. It may also be adapted to indicate gallonage or weight of liquids. Scales may be calibrated to read in any desired unit of measure or weight.

PETROMETER CORP.
4 Star Square
LONG ISLAND CITY, N. Y.

For addresses, see pages 54-58

GAGES, Oil
Abercrombie Pump Co.
Bailey Meter Co.
Boston Auto Gage
Mason-Neilan Regulator
Nathan Mfg. Co.
Penberthy Injector Co.
Petrometer Corp.
Rochester Mfg. Co.
U. S. Gauge Co.

GAGES, Optical
Bausch & Lomb Optical
Chicago Dial Ind. Co.
Clark & Sons
Fecker, J. W.
Gaertner Scientific Corp.
Jones & Lamson Machine
Scherr Co.
United Cinephone Corp.
Zeiss, Inc., Carl

GAGES, Paint Film
General Elec. Co.
Munsell Color Co.
Saxl Inst. Co.
Southw'n Electronics Labs

GAGES, Paper Thickness (See Gages, Thickness)

GAGES, Piston Ring
Holz, Herman
Wilkening Mfg. Co.

GAGES, Pitch Diameter
Brown & Sharpe
Federal Prod. Corp.
Greenfield Tap & Die
Pratt & Whitney
Scherr Co., Inc.
Union Tool Co.
Van Keuren Co.
West & Dodge Thr. Gage

GAGES, Plug
Brown & Sharpe
Ford Motor Co.
Greenfield Tap & Die
Morse Twist Drill
Pratt & Whitney
Precision Gage & Tool
Sheffield Gage
West & Dodge Thr. Gage

GAGES, Pneumatic Tank
Bacharach Industrial
Mason-Neilan Regulator
Pneumercator Co.
Rochester Mfg. Co.

GAGES, Precision Measuring
Ames Co., B. C.
Brown & Sharpe
Comtor Co.
Federal Prod. Corp.
Ferner Co.
Ford Motor Co.
Gaertner Scientific Corp.
Pratt & Whitney
Scherr Co., Inc.
Sheffield Gage
Starrett Co.
Thwing-Albert Inst. Co.
Van Keuren Co.
Carl Zeiss, Inc.

GAGES, Pressure, Indicating
Abercrombie Pump Co.
Allen Elec. & Equip.
American Meter Co.
Ashton Valve Co.
Bacharach Industrial Inst.
Bailey Meter Co.
Baird Associates
Baldwin-Southwark Corp.
Bastian-Blessing
Bellfield Co.
Boeke & Co.
Bristol Co.
Brown Inst. Co.
Brush Development Co.
Central Scientific Co.
Clark Blast Meter
Commercial Eng. Labs.
Consol. Ashcroft Hancock
Continental Elec. Co.
Crew Equip. Co.
Crosby Steam Gage
Defender Automatic Reg.
Dickson Co.
Dubrovin, John
Eimer & Amend
Emery Co.
Esterline-Angus Co.
Fisher Scientific Co.
Foxboro Co.
Friez & Sons
Gas Appliance Specialties
General Elec. Co.
General Physical Lab.
Green, Henry J.
Halpern, Walter J.
Hays Corp.
Hoke, Inc.
Industrial Instrument Co.
Jerguson Gage Co.
King-Seeley Corp.
Kollsman Inst. Co.
Kurman Electric Co.
Leeds & Northrup
Leupold, Volpel & Co.
Linde Air Products Co.
Marsh Corp.
Mason-Neilan Regulator
Mercoid Corp.
Meriam Co.
Moeller Instrument Co.
Pittsburgh Equitable Met.
Precision Gage & Tool

GAGES, Pressure, Indicating (Cont'd)
Precision Therm. & Inst.
Preferred Utilities Mfg.
RCA Manufacturing Co.
Refinery Supply Co.
Republic Flow Meters
Rochester Mfg. Co.
Scientific Inst. Co.
Star Brass Mfg. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thrush & Co., H. A.
Trane Co.
Uehling Instrument Co.
United Cinephone Corp.
U. S. Gauge Co.
Victor Equipment Co.
Wagner & Son, Carl H.
Welch Mfg. Co.
Wilgus Manufacturing

GAGES, Pressure—Recording (See Gages, Pressure, Indicating)

GAGES, Pressure Temperature (See Gages, Pressure Indicating)

GAGES, Pressure, Tire
U. S. Gauge Co.

GAGES, Pressure & Vacuum (See Gages, Pressure Indicating)

GAGES, Profile
Pratt & Whitney
Precision Gage & Tool
Sheffield Gage
Stockton Profile Gauge
United Cinephone Corp.

GAGES, Radius
Starrett Co.
United Cinephone Corp.

GAGES, Rain (See Rain Gages)

GAGES, Rifle Bore
Pratt & Whitney

GAGES, Ring
Brown & Sharpe
Greenfield Tap & Die
Morse Twist Drill
Pratt & Whitney
Precision Gage & Tool
Sheffield Gage
West & Dodge Thread
Zeiss, Inc., Carl

GAGES, Screw Thread
Brown & Sharpe
Federal Prod. Corp.
Greenfield Tap & Die
Millers Falls Co.
Pratt & Whitney
Reed Smyl Tool Works
Sheffield Gage
Starrett Co.
Union Tool Co.
West & Dodge Thread
Zeiss, Inc., Carl

GAGES, Sliding
Pratt & Whitney
Van Keuren Co.

GAGES, Snap
Brown & Sharpe
Greenfield Tap & Die
Meldrum-Gabrielson
Pratt & Whitney
Precision Gage & Tool
Sheffield Gage

GAGES, Spline
Brown & Sharpe
Pratt & Whitney
Precision Gage & Tool
Sheffield Gage

GAGES, Star
Pratt & Whitney

GAGES, Strain
American Inst. Co.
Baldwin-Southwark
Binckley, G. S.
General Elec. Co.
Holz, Herman A.
Olsen Testing Machine
Pratt & Whitney
Saxl Inst. Co.
Starrett Co.

GAGES, Surface
Ames Co., B. C.
Brown & Sharpe
Genales, Andrew
Federal Prod. Corp.
Millers Falls Co.
Saxl Inst. Co.
Starrett Co.
Zeiss, Inc., Carl

GAGES, Taper
Brown & Sharpe
Federal Prod. Corp.
Precision Gage & Tool
Pratt & Whitney
Sheffield Gage
Starrett Co.

GAGES, Telescoping
Brown & Sharpe
Starrett Co.

GAGES, Thickness
American Askania Corp.
Ames Co., B. C.
Amthor Testing Inst. Co.
Brown & Sharpe
Federal Prod. Corp.
Ford Motor Co.
General Elec. Co.
Ill. Testing Labs.
Magnetic Gauge Co.
Pratt & Whitney
Precision Gage & Tool
Precision Therm. & Inst.
Randall, Frank E.
Millers Falls Co.
Pratt & Whitney
Saxl Inst. Co.
Sheffield Gage
Southw'n Electronics Labs
Speidel & Co.
Starrett Co.
Suter, Alfred
Thwing-Albert Inst. Co.
Union Tool Co.
Van Keuren Co.
Waltham Dial Gage

GAGES, Thickness, Magnetic
American Inst. Co.
Commercial Eng. Labs.
General Elec. Co.
Hickok Elec. Inst. Co.

GAGES, Tide
American Inst. Co.
Ballauf Mfg. Co.
Binckley, G. S.
Uehling Instrument Co.

GAGES, Torque
Martin Decker Corp.
Riehle Div.
Saxl Inst. Co.
Toledo Scale Co.

GAGES, Vacuum (See Gages, Pressure)

GAGES, Venturi (See Flow Meters, Venturi)

GAGES, Water Level (See Gages, Liquid Level)

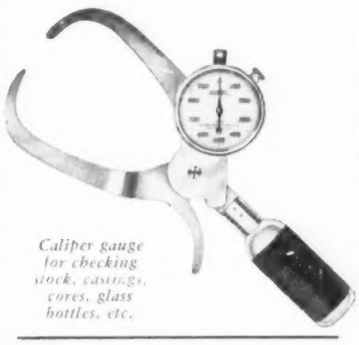
GAGES, Wind
American Inst. Co.
Detroit Air Meter
Friez & Sons
Faess, Inc.
Green, Henry J.
Kenyon Instrument Co.
Taylor Inst. Cos.

GAGES, Wire Measuring
Ames Co., B. C.
Brown & Sharpe
Federal Prod. Corp.
Greenfield Tap & Die
Pratt & Whitney
Starrett Co.

FEDERAL
DIAL GAUGES

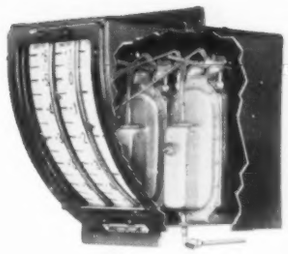
Two point contact plug gauge, either hand or bench type.

DIAL GAUGES for checking diameters, depth, thickness, and sizes of machine parts. Most complete line of standard and special gauges. *Send for catalog.*



Caliper gauge for checking stock, castings, cores, glass bottles, etc.

FEDERAL PRODUCTS CORP.
1142 Eddy St., Providence, R. I.
Detroit—Chicago—Cleveland—New York



BAILEY MULTI-POINTER GAGES

● Bailey Multi-Pointer Gages are made with any number of pointers and any scale combination from one to twelve. The pointers have 10° motion over plainly marked plastic molded scales so that readings can be taken at a distance of 20 feet. Diaphragm actuated elements enable this gage to withstand over-drafts and over-pressures without injury to the unit or its calibration.

All secondary factors such as draft, pressure, temperature, stoker speed and pulverizer feed can be indicated on one Bailey Multi-Pointer Gage.

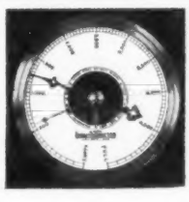
BAILEY METER COMPANY
1041 IVANHOE ROAD · CLEVELAND, O.
Bailey Meter Company Ltd., Montreal, Canada

TRU-VAC
Pirani type vacuum gauges
AC AND DC OPERATED

Our latest Model No. 20 is an AC operated gauge that will start and stop your pumping equipment at predetermined pressures.

Your inquiry invited.

CONTINENTAL ELECTRIC CO.
GENEVA, ILLINOIS



LIQUIDOMETER SENIOR

Liquidometers and Levelometers are made in a variety of sizes both in indicating or recording types to suit any depth of tank or capacity.

TANK CONTENTS GAUGES
FOR ANY LIQUID THAT FLOWS

LIQUIDOMETERS
100% automatic in operation. Liquid level changes instantaneously indicated or recorded without using outside source of power. Remote Reading models utilize an ingenious temperature compensated hydraulic transmission system, permitting long lengths of transmission tubing exposed to varying outdoor temperatures. All Liquidometers are float operated, eliminating use of pumps, valves, etc. and errors due to specific gravity differences.

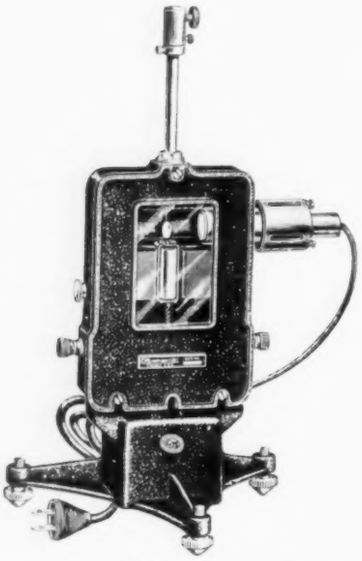
LEVELOMETERS
Utilize hydrostatic principle of establishing a balance between the head of the liquid in a tank to be measured and the indicator located at a remote point. Dial type indication with large easy to read numerals and graduations. Precision built with knife edge-bearings, they are rugged, easy to install and constructed of the finest materials.

Write for literature

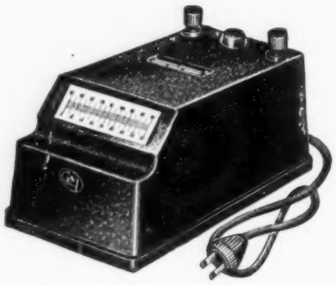
THE LIQUIDOMETER CORP.
36-28 SKILLMAN AVE., LONG ISLAND CITY, N. J.

For addresses, see pages 54-58

D'Arsonval Galvanometers



Suspended Coil Galvanometer
Sensitivity: 0.0004 to 0.003 microamperes per millimeter, at 1 meter scale distance.



Mirror Type Galvanometer
Sensitivity: 0.02 to 0.20 microamperes per millimeter scale division.

Pointer Type Galvanometer
Sensitivity: 0.10 to 1.0 microamperes per millimeter scale division.

Suspended Coil Galvanometer

You are certain of precise accuracy when you use this G-M designed suspended coil D'Arsonval galvanometer.

You also gain these four special advantages: 1) A light source is mounted in the side of the case, as an integral part of the instrument. 2) A coil lock is provided for holding the coil firmly. This reduces the probability of broken suspensions when moving the instruments. 3) A micro-adjuster screw with ratio of 25 to 1 allows accurate positioning of the coil. 4) The angle of the mirror is adjustable in relation to the coil.

This galvanometer is housed in a machined, cast aluminum case. The coil circuit can be electrostatically shielded. The suspension tube is insulated from the case, permitting a ground connection to the case independent of the coil circuit.

Write for catalog giving characteristics, accessory apparatus, and prices.

Taut Suspension Galvanometer

In G-M designed taut suspension D'Arsonval galvanometers you secure twin benefits of accuracy, plus exceptional ruggedness.

These instruments have proved particularly suitable for severe service requirements in portable use, either in student or industrial laboratories. Both shock and impact tests prove the durability of the suspension system. High angular sensitivity is combined with large scale-angle. The instruments require no special care in leveling. The coil is damped to secure minimum reading time. The instrument is well balanced mechanically to provide uniform scale accuracy.

The scales of both pointer and mirror types are inclined at an angle of 45 degrees. Scales are numbered with double sets of figures, having zero positions at the center and to the left. A zero correction knob is provided. Normally adjusted to zero center reading, the instrument may be adjusted to zero left reading at the factory. Mirror type galvanometers are furnished with lamps.

Write for catalog giving characteristics, specifications, and prices.

Super Sensitive Relay

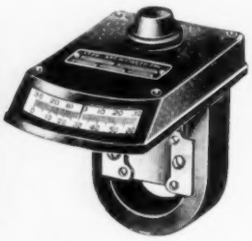
This G-M designed D'Arsonval relay is an exceptionally sensitive control instrument. The relay is of depressor bar, intermittent contacting type. Contact pressure is sufficient to control a one ampere load. The depressor bars are driven by a synchronous motor.

This relay has many control applications, such as for industrial processes, temperatures, illumination or automatic electric testing. It will also control power circuits. Write for catalog giving complete description.

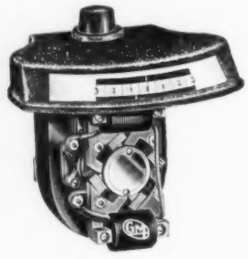
Panel Movements

Both pointer type galvanometers and super sensitive relays are provided for panel mounting. Each unit is a complete assembly. Send for the G-M catalog giving prices on these movements. The catalog contains the complete line of G-M instruments and accessory apparatus.

Super Sensitive Relay
Sensitivity: 0.125 to 1.25 microamperes per millimeter division.



Galvanometer Movement
Sensitivity: 0.10 to 1.0 microamperes per millimeter scale division.



Relay Movement
Sensitivity: 0.125 to 1.25 microamperes per millimeter division.

G-M LABORATORIES INC.

DEPT. L. 1731 BELMONT—CHICAGO, U. S. A.

ACCURATE TESTING UNITS!

BRUSH'S

CRYSTAL

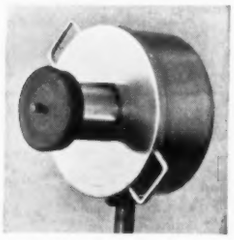
- galvanometers
- vibration pickups

Model OS-2B

For accurately studying and recording wave forms from high impedance drivers, Brush gives you its three types of crystal galvanometers, models OS-1B, OS-2B and OS-3B. Each unit is high capacitive impedance (over 20,000 ohms) and all are voltage operated devices. The OS-1B has uniform sensitivity from 1 - 1000 c.p.s., the OS-2B from 1 - 5000 c.p.s., and the OS-3B from 1 - 9000 c.p.s. This unit is especially applicable for sound-on-film recording, vibration recording and analysis, and geophysical work. Furnished with lens (focal length 10") as standard. Net price, all types . . $45.00.

Brush vibration pickups are valuable in locating the source of noise or vibration in motors, transformers, compressors and scores of mechanical devices. The Model VP-5 is an inertia type which delivers a voltage proportional to the acceleration it receives when applied to a vibrating body. Has no moving parts and can be recommended for frequencies up to 1500 cycles per second. Model VP-1 recommended for frequencies up to 10,000 cycles. Complete with 7½ ft. rubber covered (Neoprene, oil proof) shielded cable. Net price . . . $25.00.

Model VP-5



Model DP-1

The Brush Model DP-1 is a displacement type pickup designed for low frequency work. Response flat from 1 to 600 c.p.s. Will reproduce all frequencies up to 7,000 c.p.s. Vibration axis parallel with axis of pin. Complete with 6 ft. of Neoprene rubber shielded cable. Net price . . . $47.50.

BRUSH DEVELOPMENT CO.

3331 PERKINS AVE. BRUSH PIEZO ELECTRIC DEVICES CLEVELAND, OHIO

GALVANOMETERS, A-c.
Brown Inst. Co.
Brush Development Co.
Cambridge Inst. Co.
Central Scientific Co.
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Heiland Research Corp.
Leeds & Northrup Co.
Pfaltz & Bauer, Inc.
Rawson Electrical Inst.
Rubicon Co.
Ruska & Co.
Sensitive Research Inst.
Welch Mfg. Co.
Weston Elec. Inst.
Wheelco Inst. Co.

GALVANOMETERS, Astatic
Cambridge Inst. Co.
Central Scientific Co.
Chicago Apparatus Co.
Leeds & Northrup Co.
Precise Instrument Co.
Rawson Electrical Inst.
Sensitive Research Inst.
Wheelco Inst. Co.

GALVANOMETERS, D-c.
Brown Inst. Co.
Cambridge Inst. Co.
Central Scientific Co.
Chicago Apparatus Co.
General Elec. Co.
G-M Labs.
Hickok Elect. Inst. Co.
Leeds & Northrup Co.
Pfaltz & Bauer, Inc.
Rawson Electrical Inst.
RCA Manufacturing Co.
Roller-Smith Co.
Rubicon Co.
Sensitive Research Inst.
Shalleross Mfg. Co.
Simpson Elec. Co.
Tagliabue Mfg. Co.
Tinsley Electrical Inst.
W. M. Welch Mfg. Co.
Weston Elec. Inst. Corp.
Wheelco Inst. Co.

GALVANOMETERS, Piezoelectric
Brush Development Co.

GALVANOSCOPE
Central Scientific Co.

GAS ANALYZERS, Air
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Central Scientific Co.
Eimer & Amend
Fish-Schurman Co.
Fisher Scientific Co.
Friez & Sons
Hebler Co.
Mercoid Corp.
Mine Safety Appliances
Permutit Co.
Sargent & Co.
Scientific Glass App.
Tagliabue Mfg. Co.
Wilson Products, Inc.

GAS ANALYZERS, Ammonia
Cambridge Inst. Co.
Engelhard, Chas.
Mercoid Corp.
Permutit Co.
Sargent & Co.
Tagliabue Mfg. Co.

GAS ANALYZERS, Carbon Dioxide
Ace Glass Inc.
Allen Elec. & Equip.
Bacharach Industrial Inst.
Brown Inst. Co.
Cambridge Inst. Co.
Central Scientific Co.
Defender Automatic Reg.
Dwyer Mfg. Co.
Eimer & Amend
Ellison Draft Gage Co.
Engelhard, Chas.
Fish-Schurman Co.
Fisher Scientific Co.
Friez & Sons
Gow-Mac Instrument
Hays Corp.
Hebler Co.
Lantz-Phelps Corp.
Leeds & Northrup Co.
Machlett & Son
Permutit Co.
Potter Co.
Precision Therm. & Inst.
Preferred Utilities Mfg.
Republic Flow Meters
Sargent & Co.
Scientific Glass App.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Uehling Instrument Co.
Williams Apparatus Co.

GAS ANALYZERS, Carbon Monoxide
Allen Elec. & Equip.
Bacharach Industrial Inst.
Cambridge Inst. Co.
Chicago Apparatus Co.
Eclipse Aviation
Eimer & Amend
Fish-Schurman Co.
Hays Corp.
Leeds & Northrup Co.
Machlett & Son

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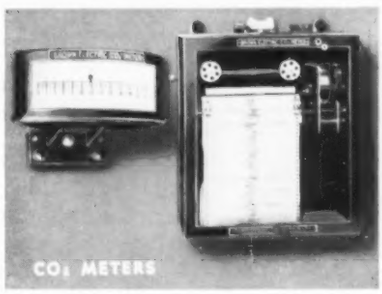

For Recording and Indicating the Per Cent CO_2 in Flue Gas

Analyzes the flue gases electrically and then transmits the readings electrically to an indicating or recording meter, or both. No moving parts or chemicals in the gas analysis cell.

Furnished in three types for recording from one to six readings on a single chart, 7" wide. Single point recorders record the per cent CO_2 on a full width chart, using an inked ribbon. Multiple models record from two to four CO_2 readings on a full width chart using a multi-colored ribbon. Multiple duplex models record from two to six readings on two sections of a full width chart, using two measuring systems and two multi-colored inked ribbons. Flue gas temperature can be recorded on same duplex chart with CO_2 reading. One, two or three temperatures and CO_2 readings can be recorded on the same duplex chart. Indicating reading is obtained directly on a 6" scale.

Write for Catalog 3005. THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4482 Wayne Avenue, Philadelphia, Pa.

BROWN ELECTRIC CO_2 METER
AND
MINNEAPOLIS-HONEYWELL CONTROL SYSTEMS
To Measure and Control is to Economize

A LABORATORY JOB DONE IN THE FIELD

HAYS PORTABLE COMBUSTION TEST SETS are equipped to handle an accurate gas analysis—right in the field.

Installations become more successful, trouble-makers are rapidly exposed, guesswork becomes a thing of the past.

Test Sets are available with all necessary equipment for the analysis for CO_2, CO, and O_2—complete with flue gas thermometer, and draft gage. For further particulars—write to 925 Eighth Avenue, Michigan City, Indiana.

THE HAYS CORPORATION
COMBUSTION INSTRUMENTS AND CONTROLS
MICHIGAN CITY, INDIANA, U.S.A.

For addresses, see pages 54-58

GAS ANALYSIS

Solves Many Problems

The Engelhard Thermal Conductivity Method of Gas Analysis has enabled many plants to control operations closely. It has resulted in products consistently uniform at a considerable saving in time and money.

You can analyze—for example:

Hydrogen	**Argon**
Carbon Dioxide	**Nitrous Oxide**
Sulphur Dioxide	**Acetone**
Ammonia	**Helium**

We shall be glad to consider special problems.

SEND FOR LITERATURE

Charles Engelhard, Inc.

90 Chestnut St. Newark, N. J.

Manufacturers of Pyrometers, Resistance Thermometers, Combustion Indicators, Exhaust Gas Analysers, Flue Gas Analysers, Thermocouples.

GOW-MAC

AIR FUEL RATIO and CO_2 METERS

FOR COMBUSTION EFFICIENCY

in furnace and engine on road or in shop

FOR QUALITY CONTROL

in industry where CO or hydrogen are used

FOR SAFETY

in maintaining inert gases at standards of normal or reducing atmospheres

GOW-MAC INSTRUMENT COMPANY

20 Washington Pl. Newark, N. J.

GAS ANALYZERS, Carbon Monoxide (Cont'd)
Mine Safety Appliances
Sargent & Co.
Scientific Glass App.
Scientific Inst. Co.
Tagliabue Mfg. Co.

GAS ANALYZERS, Chlorinated Hydrocarbons
Wilson Products, Inc.

GAS ANALYZERS, Flue Gas (See Gas Analyzers, Carbon Dioxide)

GAS ANALYZERS, Hydrogen
Bacharach Industrial Inst.
Chicago Apparatus Co.

GAS ANALYZERS, Hydrogen Sulphide
American Meter
Brown Inst. Co.
Bushnell, R. O.
Cambridge Inst. Co.
Connelly Iron Sponge
Eimer & Amend
Mine Safety Appliances
Sargent & Co.
Scientific Glass Apparatus

GAS ANALYZERS, Nitric Oxide
Cambridge Inst. Co.
Eimer & Amend
Rubicon Co.
Sargent & Co.

GAS ANALYZERS, Orsat
Ace Glass Inc.
Bailey Meter Co.
Central Scientific Co.
Chicago Apparatus Co.
Defender Automatic Reg.
Dwyer Mfg. Co.
Eimer & Amend
Ellison Draft Gage
Fish-Schurman Co.
Fisher Scientific Co.
Hays Corp.
Machlett & Son
Precision Therm. & Inst.
Sargent & Co.
Scientific Glass App.
Specialty Glass Co.

GAS ANALYZERS, Oxygen
Chicago Apparatus Co.
Cambridge Inst. Co.
Eclipse Aviation
Eimer & Amend
Hays Corp.
Hebler Co.
Linde Air Products Co.
Mine Safety Appliances
Sargent & Co.
Scientific Glass App.
Tagliabue Mfg. Co.

GAS ANALYZERS, Oxygen & Nitrogen Apparatus
Boekel & Co.
Cambridge Inst. Co.
Central Scientific Co.
Eimer & Amend
Hebler Co.
Linde Air Products Co.
Sargent & Co.
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Eimer & Amend
Engelhard, Chas.
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Hebler Co.
Leeds & Northrup Co.
Sargent & Co.
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Tagliabue Mfg. Co.
Uehling Instrument Co.

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Central Scientific Co.
Ess Inst. Co.
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Refinery Supply Co.
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Brown Inst. Co.
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Zuhr, Inc., Henry

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Gilmore, E. R.
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Southw'n Electronics Labs.
Taylor Inst. Cos.
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GAS METERS, INFERENTIAL — Area (See Flowmeters, Area)

GAS METERS, INFERENTIAL — Flownozzle (See Flowmeters, Nozzle)

GAS METERS, INFERENTIAL—Orifice (See Flowmeters, Orifice)

GAS METERS, INFERENTIAL — Pitot-tube (See Flowmeters, Pitot-tube)

GAS METERS, INFERENTIAL—Venturi (See Flowmeters, Venturi)

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Cleveland Gas Meter
Lambert Meter Co.
Pittsburgh Equit. Meter
Sprague Meter Co.

GAS METERS, POSITIVE, Rotary
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GAS METERS, POSITIVE, Special for extremely small flows
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Machlett & Son
Thermal Syndicate Ltd.

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Barkon-Frink
Central Scientific Co.
Gen. Elec. Vapor Lamp
General Physical Lab.
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GAS & VAPOR DISCHARGE TUBES, Nitrogen
Central Scientific Co.
General Physical Lab.

GAS & VAPOR DISCHARGE TUBES, Sodium
Central Scientific Co.
Gen. Elec. Vapor Lamp

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Ferris Inst. Corp.
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Cambridge Inst. Co.
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Heiland Research Corp.
Mico Instrument Co.
Ruska & Co., Inc.
Sensitive Research Inst.

GEOPHYSICAL INSTRUMENTS, Gravity Meters
Brown Gravity-Meter

GILLMORE NEEDLES (See Needles, Gillmore)

GLARE METER
Akatos, Inc.
Central Scientific Co.
Gaertner Scientific Corp.
Saxl Inst. Co.

GLASS STRAIN TESTERS (See Testers & Testing Machines, Glass Strain)

GLASS TUBING, Heat Resisting
Corning Glass Works
Fish-Schurman Co.
Kimble Glass Co.

GLASS TUBING, Ultra-Violet Transmitting
Corning Glass Works
Fish-Schurman Co.
General Elec. Co.

GLASS TUBING, Ultra-Violet Transmitting Opaque to Visible Black-Ray Lighting
Corning Glass Works
Fish-Schurman Co.
General Elec. Co.

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Gaertner Scientific Corp.
Pfaltz & Bauer, Inc.
Saxl Inst. Co.
Sensitive Research Inst.
Suter, Alfred
Zeiss, Inc., Carl

GONIOMETER
Automatic Temp. Control
Fuess, Inc.
Hayes Scientific App.
Zeiss, Inc., Carl

GOVERNORS (See also object of measurement and control)

GOVERNORS, Air (See Regulators, Automatic, Air)

GOVERNORS, District
American Meter Co.
Connelly Iron Sponge
Pittsburgh Equit. Meter

GOVERNORS, Engine
Cash Co.
Hanlon-Waters, Inc.
Judson Governor Co.
Mason-Neilan Regulator
Pittsburgh Equit. Meter

GOVERNORS, Gas (See Regulators, Automatic, Air)

GOVERNORS, Hydraulic
Allis-Chalmers Mfg.
Cash Co.
Hagan Corp.
Hanlon-Waters, Inc.
Schade Valve Mfg.
Tagliabue Mfg. Co.

GOVERNORS, Liquid Level (See Controllers, Automatic, Liquid Level)

GOVERNORS, Pressure (See Regulators, Automatic, Air)

GOVERNORS, Pump (See Regulators, Automatic, Air)

GOVERNORS, Station
Connelly Iron Sponge

GOVERNORS, Steam (Regulators, Automatic, Air)

GOVERNORS, Turbine
Cash Co.
Hagan Corp.
Mason-Neilan Regulator

GRADUATING MACHINES (See Dividing Machines)

GRAIN TESTERS (See Testers, Grain)

GRAPHIC (See object of measurement and control)

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Bin-Dicator Co.

GRANULAR MATERIALS MEASUREMENTS, Particle Size Separator
Fed. Pneumatic Systems

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GRANULAR MATERIALS MEASUREMENTS, Volume Integrating Meters
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Builders Iron Foundry
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GRANULAR MATERIALS MEASUREMENTS, Weight-Integrating Meters
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Eimer & Amend
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Foxboro Co.
Refinery Supply Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.

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HARDNESS TESTER (See Testers & Testing Machines, Hardness)

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Mico Instrument Co.
Scientific Apparatus Co.
United Transformer Corp.

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Eastern Science Co.
Fecker, J. W.
Gaertner Scientific Corp.

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International Resistance

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HORIZONS, ARTIFICIAL (See Artificial Horizons)

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Friez & Sons
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HUMIDITY INSTRUMENTS, Aspiration Psychrometric (See Psychrometers, Aspiration)

HUMIDITY INSTRUMENTS, Conductivimetric
Industrial Insts. Inc.

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Schultheis Corp., E. W.
Scientific Glass Apparatus
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Mason-Neilan Regulator
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Huddleston, J. S. F.
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Palmer Co.
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Moeller Instrument Co.
Muter Company
Parke-Cramer Co.
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THE TYPE VI DIRECT PRESSURE

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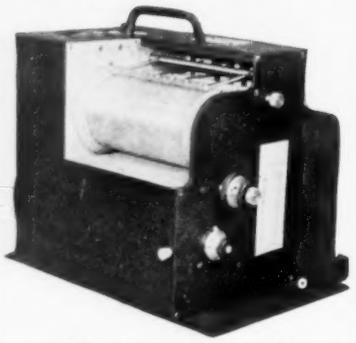

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Sperry Sun Well Surveying

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Commercial Engg. Labs.
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Pioneer Instrument Co.
Robertson, 3rd. J. L.
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Trill Indicator Co.

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KVA RECORDERS
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Parr Instrument Co.
Precision Scientific Co.
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Gaertner Scientific Corp.
Leitz, Inc.
Pfaltz & Bauer, Inc.
Spencer Lens Co.
Zeiss, Inc., Carl

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General Scientific Corp.
Goerz Amer. Optical Co.

LENSES, Polarized
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Polarizing Inst. Co.
Valpey Crystals
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General Scientific Corp.
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Speidel & Co.
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Valpey Crystals
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LENSES, Special
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Warren-Knight Co.
White Co., Inc., David

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LEVELS, Engineer's (See Surveying Instruments)

LEVELS, Hand
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Berger & Sons
Fish-Schurman Co.
Glogau & Co.
Gurley, W. & L. E.
Kern Co.
Keuffel & Esser Co.
Leupold Volpel & Co.
Scherr Co., Inc.
Starrett Co.
Warren-Knight Co.
White Co. Inc., David
Zeiss, Inc., Carl

LEVELS, Prism
Fecker, J. W.
Kern Co.
Keuffel & Esser Co.
Taylor Inst. Cos.
White Co. Inc., David

LEVELS, Surveying (See Surveying Instruments)

LEVELS, Wye (See Surveying Instruments)

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Weston Elec. Inst. Corp.
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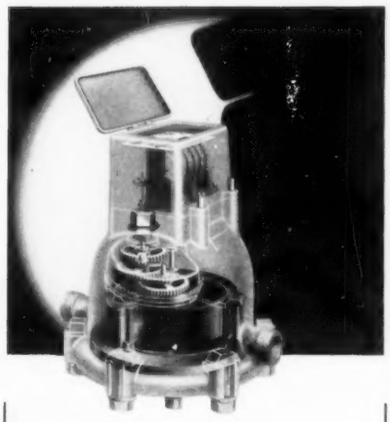

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SIMPLEST AND MOST EFFICIENT
Bulletin 504

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Barkon-Frink
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Fish-Schurman Co.
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Gen. Elec. Vapor Lamp
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Gen. Elec. Vapor Lamp
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LIGHT SOURCES, Sodium
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Central Scientific Co.
Gaertner Scientific Corp.
Gen. Elec. Vapor Lamp
Leitz, Inc.
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Gaertner Scientific Corp.
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General Physical Lab.
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Leitz, Inc.
Mico Instrument Co.
Pfaltz & Bauer, Inc.
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Gen. Elec. Vapor Lamp
General Physical Lab.
United Cinephone Corp.

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Triumph Mfg. Co.
Wallace-Tiernan

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Van Keuren Co.

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National Meter Co.
Neptune Meter Co.
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LIQUID METERS, Volumetric Types, Oscillating Piston
Badger Meter Co.
Campion Labs.
National Meter Co.
Neptune Meter Co.
Worthington-Gamon Met.

LIQUID METERS, Volumetric Types, Reciprocating Piston
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Pgh. Equitable Meter

LIQUID METERS, Volumetric, Rotary Piston
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Bowser & Co.
National Meter Co.
Neptune Meter Co.
Pgh. Equitable Meter
Smith Meter Co.

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Commercial Eng. Labs.
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McCord Radiator & Mfg.

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Fisher Governor Co.
Friez & Sons
General Controls Co.
Hagan Corp.
Hanlon-Waters, Inc.
Mason-Neilan Regulator
Natural Gas Equipment

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LUSTER METERS
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Leitz, Inc.
Saxl Inst. Co.
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MAGNETOMETERS
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Baird Associates
Builders Iron Foundry
Cambridge Inst. Co.

MAGNETOMETERS (Cont'd)
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Precise Instrument Co.
Welch Mfg. Co.

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Fish-Schurman Co.
Fuess, Inc.
Glogau & Co.
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Keuffel & Esser Co.
Kollmorgen Optical Co.
Lincoln Optics
Spindler & Co.
Spencer Lens Co.
Testrite Instrument Co.
Warren Knight Co.
Zeiss, Inc., Carl

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MANOMETERS, Electric
Brown Inst. Co.

MANOMETERS, High Pressure
Daniel Orifice Fitting

MANOMETERS, Inclined Tube
American Blower Corp.
Bacharach Industrial Inst.
Bailey Meter Co.
Consol. Ashcroft Hancock
Defender Automatic Reg.
Detroit Air Meter Co.
Dwyer Mfg. Co.
Friez & Sons

MANOMETERS, Inclined Tube (Cont'd)
Fuess, Inc.
Hays Corp.
H-B Inst. Co., Inc.
Meriam Co.
Precision Therm. & Inst.

MANOMETERS, Micro
Bacharach Industrial Inst.
Cambridge Inst. Co.
Fuess, Inc.
Welch Mfg. Co.

MANOMETERS, Remote-reading
Bailey Meter Co.
Brown Inst. Co.

MANOMETERS, Single-tube & Reservoir
Ace Glass Inc.
Bacharach Industrial Inst.
Bailey Meter Co.
Commercial Engg. Labs.
Connelly Iron Sponge Co.
Defender Automatic Reg.
Detroit Air Meter Co.
Dwyer Mfg. Co.
Gas Appliance Specialties
Lantz Phelps Corp.
Meriam Co.
Morey & Jones, Ltd.
Precision Therm. & Inst.
Scientific Inst. Co.

MANOMETERS, U-tube, Electric Transmitting
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Bailey Meter Co.
Precision Therm. & Inst.
Southwest Electronics Labs.

Bacharach Industrial Instrument Co.
7006 BENNETT ST. PITTSBURGH · PA.

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FOR INDUSTRIAL AND LABORATORY USE. REQUEST BULLETIN 135

For addresses, see pages 54-58

MANOMETERS, U-tube, Glass
Ace Glass, Inc.
Annis Co.
Bacharach Industrial Inst.
Builders Iron Foundry
Connelly Iron Sponge
Cutsol, Ashcroft Hancock
Defender Automatic Reg.
Detroit Air Meter Co.
Dwyer Mfg. Co.
Eimer & Amend
Fish-Schurman Co.
Fisher Scientific Co.
Halpern, Walter J.
Hays Corp.
Jensen Inst. Co.
Kimble Glass Co.
Lambert Meter Co.
Macalaster Bicknell Co.
Machlett & Son
Meriam Co.
Mine Safety Appliances
Moeller Instrument Co.
Morey & Jones, Ltd.
Precision Therm. & Inst.
Rascher & Betzold
Refinery Supp'y Co.
Ruth Glass Division
Scientific Inst. Co.
Specialty Glass Co.
Tagliabue Mfg. Co.
Vapor Recovery Systems
Wilkens-Anderson Co.

MANOMETERS, U-tube, Metal
Cambridge Inst. Co.
Connelly Iron Sponge
Mason-Neilan Regulator
Precision Therm. & Inst.
Scientific Inst. Co.
Taylor Inst. Cos.

MARINE INSTRUMENTS (See Nautical Instruments)

MARINE INSTRUMENTS, Gyro-Compass & Gyro-Pilot
Sperry Gyroscope Co.

MASTER CLOCKS (See Clocks, Master)

MEASURING MACHINES, Lineal
Durant Mfg. Co.
Ferner Co.
Fidelity Mach. Co.
Gaertner Scientific Corp.
Pratt & Whitney

MEASURING MACHINES, Wire
Durant Mfg. Co.
Minneapolis Elec. & Const.
Pratt & Whitney

MEGOHMMETERS
Bernard, H. J.
Biddle Co., Jas. G.
Cambridge Inst. Co.
Clough-Brengle Co.
General Elec. Co.
General Radio Co.
Ill. Testing Labs.
Industrial Instruments
Martindale Electric Co.
Rawson Electrical Inst.
RCA Manufacturing Co.
Sensitive Research Inst.
Shallcross Mfg. Co.
Sticht & Co.
Weston Elec. Inst. Corp.

MEGOHM VOLTMETERS (See Voltmeters, Megohm)

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American Inst. Co.
Central Scientific Co.
Corning Glass Works
Eimer & Amend
Ferner Co.
Fisher Scientific Co.
Humboldt Mfg. Co.
Machlett & Son
Microchemical Service
Parr Instrument Co.
Pfaltz & Bauer, Inc.
Precision Scientific Co.
Scientific Glass Apparatus
Southw'n Electronics Labs.
Tagliabue Mfg. Co.
Western Machinery Co.

METAL DETECTORS (See Detectors, Metal)

METALLIC BELLOWS (See Bellows, Metallic)

METALS, Thermostatic
Chace Co.
General Plate

METEOROLOGICAL INSTRUMENTS
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American Inst. Co.
Am. Paulin System
Friez & Sons

METEOROLOGICAL INSTRUMENTS (Cont'd)
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Geophysical Instrument
G. M. Mfg. Co., Inc.
Green, Henry J.
Moeller Instrument Co.
Precision Therm. & Inst.
Taylor Inst. Cos.

METER PROVERS, Gas
American Meter Co.
Lambert Meter Co.
Pgh. Equitable Meter Co.

METERS, Acid (See Acidimeters)

METERS, Ampere Hour (See Ampere Hour Meters)

METERS, Coal (See Coal Meters)

METERS, Compressed Air
American Meter Co.
Bailey Meter Co.
Mason-Neilan Regulator
N. J. Meter
Taylor Inst. Cos.

METERS, Condensation
Am. Dist. Steam Co.
Bailey Meter Co.
Buffalo Meter Co.
Central Station Steam
Henszey Co.
Taylor Inst. Cos.

METERS, Conductivity (See Conductivity Meters)

METERS, Consumer's, Electric
General Elec. Co.
Westinghouse Elec. & Mfg.

METERS, Consumer's, Gas
American Meter Co.
Lambert Meter Co., Inc.

METERS, Current, Air & Gas
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Mason-Neilan Regulator
Pgh. Equitable Meter Co.

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Bowser & Co.
Builders Iron Foundry

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Keuffel & Esser Co.
Mason-Neilan Regulator
National Meter Co.
Neptune Meter Co.
Pgh. Equitable Meter Co.
Scientific Inst. Co. (Calif.)
Uehling Instrument Co.
Worthington-Gamon Meter

METERS, Decibel (See Sound Level Meters)

METERS, Demand, Electric
Electric Indicator Co.
General Elec. Co.
HD Elec. Co.
Landis & Gyr, Inc.
Lincoln Meter Co.
Sangamo Electric Co.
Westinghouse Elec. & Mfg.

METERS, DEMAND, Gas
American Meter Co.
Bailey Meter Co.
Bendix Marine Products
Lambert Meter Co.
Mason-Neilan Regulator
Pgh. Equitable Meter Co.

METERS, Demand Limiting
American Meter Co.
Annis Co.
General Elec. Co.
Landis & Gyr, Inc.
Lincoln Meter Co.
Mason-Neilan Regulator
Westinghouse Elec. & Mfg.

METERS, Earth Current
Geophysical Inst. Co.
Rawson Electrical Inst.
Southw'n Electronics Labs.

METERS, Electronic
Ballantine Labs.
Cambridge Inst. Co.
Clough-Brengle Co.
Luxtrol Co., Inc.
RCA Manufacturing Co.
Southw'n Electronics Labs.

METERS, Flow (See Flowmeters)

METERS, Footage (See Counters, Footage)

METERS, Foot-candle (See Foot-candle Meters)

METERS, Frequency (See Frequency Meters)

METERS, Gas (See Gas Meters)

METERS, Gas-Dry Test
American Meter Co.
Lambert Meter Co.
Pgh. Equitable Meter Co.
Tagliabue Mfg. Co.

METERS, Gas-Integrating
American Meter Co.
Bailey Meter Co.
Brown Inst. Co.
Foxboro Co.
Lambert Meter Co.
Mason-Neilan Regulator
Tagliabue Mfg. Co.
Taylor Inst Cos.

METERS, Gas-Wet Test
American Meter Co.
Lambert Meter Co.
Tagliabue Mfg. Co.

METERS, Gasoline (See Liquid Meters)

METERS, Gas, Station
Bowser & Co.
Pgh. Equitable Meter Co.

METERS, High Pressure & High Pressure Distribution
Pgh. Equitable Meter Co.

METERS, Hydrogen Ion (See Testers, Hydrogen Ion)

METERS, Mileage
Gauthier, Donat A.
Jaeger Watch Co.
Ohmer Register
Veeder-Root, Inc.

METERS, Multi-Rate
Landis & Gyr, Inc.

METERS, Oil (See Liquid Meters)

METERS, Orifice (See Flowmeters, Orifice)

METERS, Oxygen
American Meter Co.
Bailey Meter Co.
Brown Inst. Co.
Pgh. Equitable Meter Co.

METERS, Pitot Tube (See Flowmeters, Pitot Tube)

METERS, Positive Displacement (See Gas Meters, Positive and Liquid Meters, Volumetric)

METERS, Prepayment
American Meter Co.
Landis & Gyr, Inc.

METERS, Proportional
American Meter Co.
Bristol Co.
Mason-Neilan Regulator
National Meter Co.
Pgh. Equitable Meter Co.
Taylor Inst. Cos.

METERS, Reactive Component
Andrew, Victor J.
General Elec. Co.
Landis & Gyr, Inc.
Westinghouse Elec. & Mfg.

METERS, Rotary Displacement
Bowser & Co.
Neptune Meter Co.
Pgh. Equitable Meter Co.

METERS, Sewage
American Meter Co.
Bailey Meter Co.
Brown Inst. Co.
Builders Iron Foundry
Mason-Neilan Regulator
Morey & Jones, Ltd.
Pgh. Equitable Meter Co.
Taylor Inst. Cos.

METERS, Shunt
Builders Iron Foundry
Columbia Elec. Mfg.
Daven Co.
Rawson Electrical Inst.
Wheelco Inst. Co.

METERS, Station
American Meter Co.

METERS, Steam (See Flowmeters, Steam)

METERS, Time
Cameron Labs.
Cramer & Co., Inc.
Elec. Tachometer Corp.
General Elec. Co.
Jaeger Watch Co.
Luers, J. Milton
National Instrument Co.
Paragon Electric Co.
Rawson Electrical Inst.
Thompson Clock Co.
Warren Telechron Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

METERS, Venturi (See Flowmeters, Venturi)

METERS, V-notch (See Flowmeters, Weir)

METERS, Volumetric, Positive Displacement (See Gas Meters, Positive; see Liquid Meters, Volumetric)

METERS, Water (See Liquid Meters, Volumetric; also Flowmeters, Liquid)

METERS, Watt-Hour
Duncan Electric
General Elec. Co.
Landis & Gyr, Inc.
Sangamo Electric Co.
Westinghouse Elec. & Mfg.

METERS, Weir (See Flowmeters, Weir)

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Akatos, Inc.
Dietert Co.
Gaertner Scientific Corp.
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MICROFARADMETERS
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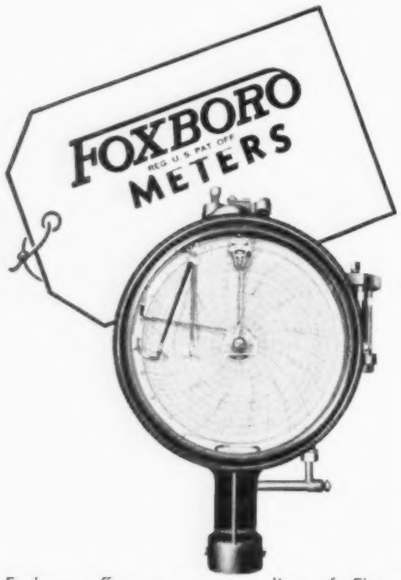
Clough-Brengle Co.

MICRO-MANIPULATORS
Hoffman Co., S. O.
Industrial Instruments
Mico Instrument Co.
Zeiss, Inc., Carl

MICROMANOMETERS (See Manometers, Micro)

MICROMETERS, Calendar
Coats Mach. Tool Co.
Precision Therm. & Inst.



Foxboro offers a complete line of Flow Meters for measuring steam, gas, air, oil, water, acids and other fluids. These meters are of the orifice type—simple in design, powerful, with a straight-line motion that assures permanent calibration and long life. They can be furnished with direct-reading integrator to give total flow. Recorders may also be equipped with pressure, temperature and integrator pens.

For complete information write for Bulletin No. 200-2 and Bulletin No. 692. The Foxboro Company, 46 Neponset Avenue, Foxboro, Mass., U. S. A. Branch offices in 25 Principal Cities.

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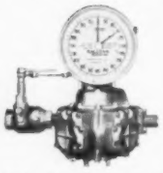
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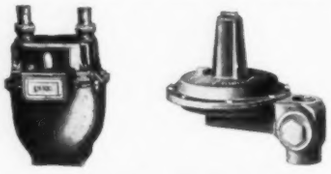
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PRODUCTION
Individually Designed Equipment for Measurement, Control and Test, to Meet Special Requirements.
L. A. B. CORP.
SUMMIT NEW JERSEY

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MICROMETERS, Dial
Ames Co., B. C.
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Federal Prod. Corp.
Glogau & Co.
Haines Gauge Co.
Randall, Frank E.
Scherr Co., Inc.
Starrett Co.
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MICROMETERS, Filar Eyepiece
Gaertner Scientific Corp.

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Reed Small Tool Works
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Zeiss, Inc., Carl

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Gen. Biological Supply
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Welch Mfg. Co.

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Pfaltz & Bauer, Inc.
Scherr Co., Inc.
Spencer Lens Co.
Zeiss, Inc., Carl

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Detroit Testing Mach.
Fisher Scientific Co.
Fuess, Inc.
Gaertner Scientific Corp.
Holz, Herman A.
Leitz, Inc.
Pittsburgh Inst. & Mach. Riehle Division
Suter, Alfred

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Spencer Lens Co.

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Fecker, J. W.
Fuess, Inc.
Gaertner Scientific Corp.
Leitz, Inc.
Scherr Co., Inc.
Spencer Lens Co.
Zeiss, Inc., Carl

MICROSCOPES, Inspection (See Microscopes, Finish Comparison)

MICROSCOPES, Measuring
Bausch & Lomb Optical
Central Scientific Co.
Fecker, J. W.

MICROSCOPES, Measuring (Cont'd)
Fuess, Inc.
Gaertner Scientific Corp.
Kern Co.
Leitz, Inc.
Mico Instrument Co.
Scherr Co., Inc.
Zeiss, Inc., Carl

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Leitz, Inc.
Mico Instrument Co.
Pfaltz & Bauer, Inc.
Scherr Co., Inc.
Zeiss, Inc., Carl

MICROSCOPES, Petrographical
Bausch & Lomb Optical
Fuess, Inc.
Leitz, Inc.
Spencer Lens Co.
Zeiss, Inc., Carl

MICROSCOPES, Thread Contour (See Microscopes, Finish Comparison)

MICROSCOPES, Toolmaker's
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Fuess, Inc.
Gaertner Scientific Corp.
Goerz Amer. Optical
Leitz, Inc.
Mico Instrument Co.
Scherr Co., Inc.
Zeiss, Inc., Carl

MICROSCOPES, Wire Gaging
Bausch & Lomb Optical
Zeiss, Inc., Carl

MICROTOMES
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Cambridge Inst. Co.
Central Scientific Co.
International Equip. Co.
Leitz, Inc.
Mico Instrument Co.
Pfaltz & Bauer, Inc.
Spencer Lens Co.
Thomas Co., Arthur H.

MICROVOLTMETERS (See Voltmeters, Micro)

MILEAGE METERS (See Meters, Mileage)

MILITARY INSTRUMENTS (See Ordnance Instruments)

MILK TESTERS (See Testers, Milk)

MILLIAMMETERS (See Ammeters, Milliammeters)

MILLIOHMMETERS (See Ohmmeters, Milliohmmeters)

MILLIVOLTMETERS (See Voltmeters, Millivoltmeters)

MINE GAS INDICATORS (See Detectors, Mine Gases)

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Keuffel & Esser Co.

MIRRORS, Astro
Fecker, J. W.

MIRRORS, Azimuth Circle
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Master Optical Co.
Perkin, Elmer & Moffitt

MIRRORS, Galvanometer
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Perkin, Elmer & Moffitt
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MIRRORS, Octant
Keuffel & Esser Co.
Kollmorgen Optical Co.
Perkin, Elmer & Moffitt

MIRRORS, Parabolic
Clark & Sons

MIRRORS, Plano
Fuess, Inc.
Kollmorgen Optical Co.
Master Optical Co.
Perkin, Elmer & Moffitt

MIRRORS, Sextant
Fecker, J. W.
Fish-Schurman Co.
Keuffel & Esser Co.
Kollmorgen Optical Co.
Master Optical Co.
Perkin, Elmer & Moffitt
Warren-Knight Co.

MIRRORS, Spherical
Clark & Sons

MIRRORS, Spherical Stellite
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Fuess, Inc.
Kollmorgen Optical Co.
Master Optical Co.
Perkin, Elmer & Moffitt

MIRRORS, Stadimeter
Gurley, W. & L. E.
Keuffel & Esser Co.
Kollmorgen Optical Co.
Master Optical Co.
Perkin, Elmer & Moffitt

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Andrew, Victor J.
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RCA Manufacturing Co.
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Brown Inst. Co.
Cambridge Inst. Co.
Fuess, Inc.
Industrial Inst. Inc.
Saxl Inst. Co.
Shallcross Mfg. Co.
Southw'n Electronics Labs
Tagliabue Mfg. Co.
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American Inst. Co.
American Moistening Co.
Cambridge Inst. Co.
Central Scientific Co.
Dietert Co.
Eimer & Amend
Humboldt Mfg. Co.
Industrial Inst. Inc.
Precision Scientific Co.

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Scientific Inst. Co.
Shallcross Mfg. Co.
Sodemann Heat & Power
Southw'n Electronics Labs
Tagliabue Mfg. Co.
Toledo Scale Co.
Troemner, Henry
Williams Apparatus Co.

MOLECULAR STILLS
Distillation Prod., Inc.

MONOCHROMATIC LIGHT SOURCES (See Light Sources, Monochromatic)

MONOCHROMATORS
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American Askania Corp.
Baird Associates
Fuess, Inc.
Gaertner Scientific Corp.
Leitz, Inc.
Zeiss, Inc., Carl

MOTION, Indicators
Bristol Co.
Brush Development Co.
Elec. Tachometer Corp.
Foxboro Co.
Mason-Neilan Reg. Co.
Photoswitch, Inc.

MOTION, Recorders
American Automatic Elec.
Bristol Co.
Brush Development Co.
Elec. Tachometer Corp.
Foxboro Co.
Mason-Neilan Reg. Co.

MOTOR STARTERS (See Starters, Motor)

MOTORS, Fractional Horsepower
Barber-Coleman Co.
Bodine Elec. Co.
Eclipse Aviation
Elsbett Mfg. Co.
General Elec. Co.
Sterling Electric Motors
Warren Telechron Co.

MOTORS, Laboratory
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Central Scientific Co.
Eastern Engg. Co.
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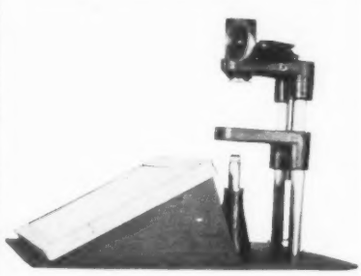

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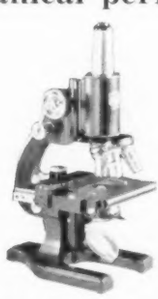

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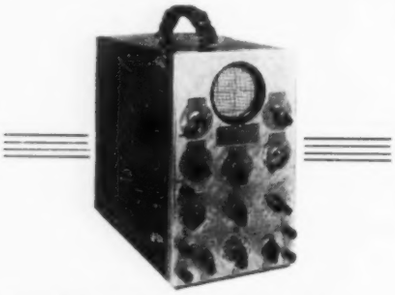

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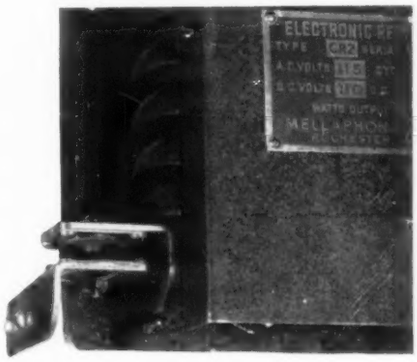

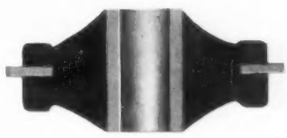

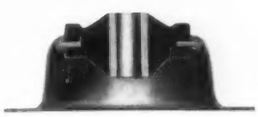

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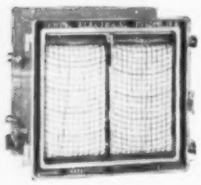

Fig. 1—Model 28 Recording Pyrometer, Multiple Recorder. Makes 2, 4 or 6 records on continuous roll, twin charts. Dot and dash records, one color of ink. Metal case construction. Simplified and rugged. Automatic chart re-roll. Also furnished single record type.

Fig. 5—Wall pattern, high resistance type, direct reading, furnished for any desired temperature range. Made in three sizes, with 5 inch, 6 inch or 7½ inch long temperature scales.

Fig. 6—Standard portable pattern. High resistance, single or double temperature ranges. Compact, strong, contained in enameled aluminum case.

Fig. 2—Model 19 MC Recording Pyrometer, single and multiple record types. Choice of spring drive or electric drive. Daily chart. Dot and dash records, metal case construction. Operates with minimum of attention.

Fig. 7—Portable Laboratory Pattern, high resistance, single or double temperature ranges, 6 inch temperature scale, anti-parallax mirror. Contained in polished mahogany case.

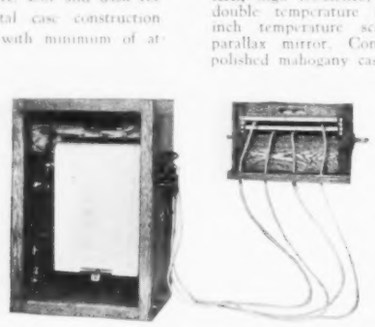

Fig. 3—Model 19 Recording Pyrometer. Single- and multiple-record recorders, daily chart, dot and dash recording, hardwood case, spring drive or electric drive. Can be used with switchboard and records obtained of desired maximum number of heat sources. Rugged, simple and foolproof.

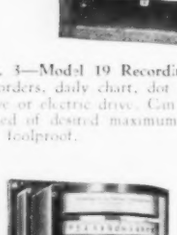

Fig. 4—Model 30 Pyrometer with rotary selector switch mounted together in moisture, fume and dust proof case. Furnished with switch capacities 4, 6, 8, 12, 24 and 32 points and off position. Especially suitable for diesel engine service, ceramic plants, etc.

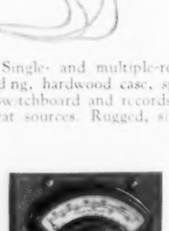

Fig. 8—Type JR Multiple Point Pyrometer: Unit Construction, low resistance type, metal case construction. Switch furnished with 2, 4, 9 and 12 points and off position.

Fig. 9—Type JR Individual Pyrometer, low resistance type, furnished mounted on cast aluminum tripod bracket.

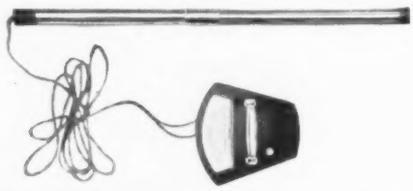

Fig. 10—Portable Radiation Pyrometer for indicating high temperatures to 5000 degrees Fahrenheit. Readings obtained by radiation receiving tube collecting heat radiations from hot object. Ideal for temperature readings of fire boxes, kilns of all kinds, etc.

Fig. 11—A5X Pyrometer, most practical and economical pyrometer for non-ferrous foundries. Thermocouple wire contained in magazine, is drawn out as needed. Junctions made by twisting wires together. Quick acting, temperature readings in eight seconds.

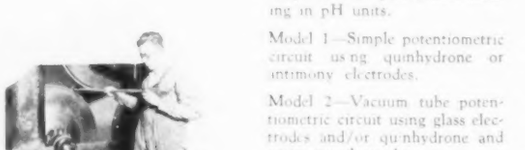

Fig. 12—Surface Temperature Pyrometer, for reading surface temperatures of revolving rolls, press platens, hot steel, etc. Contact thermocouple made in form suitable for individual application. Readings obtained in few seconds.

Fig. 14—Radiation Pyrometer receiving tube, enclosed type, for permanent installation, thermo element enclosed, has lens and mirrors to intensify and concentrate heat radiations. Also furnished with water jacket for installation in high ambient temperature.

Fig. 15—Portable pH Meters, range 0 to 14 pH. Direct reading in pH units.

Model 1—Simple potentiometric circuit using quinhydrone or antimony electrodes.

Model 2—Vacuum tube potentiometric circuit using glass electrodes and/or quinhydrone and antimony electrodes.

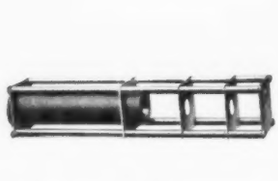

Fig. 13—Radiation Pyrometer receiving tube, ventilated type, for permanent installation, thermo element enclosed.

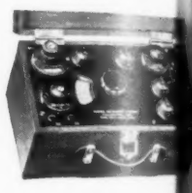

Fig. 16—Treasure Chest, accurate potentiometer complete pyrometer and thermocouple testing and calibrating set combined in a single portable instrument. Self-checking with Electrocrit checking circuit.

Fig. 17 — Portable Indicating Electrical Resistance Thermometer, has rotary switch for reading temperature readings of separate heat sources.

Fig. 18—Resistometer, a precision measuring instrument for wheatstone bridge work. Specially designed for testing, checking and calibrating electrical resistance thermometers and resistance thermometer bulbs.

Fig. 19—Automatic Control very sensitive, controls temperatures accurately and automatically. Gives required temperature protection. Applicable to oil, gas and electrically heated furnaces, etc.

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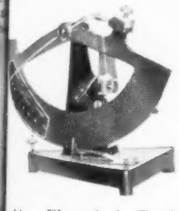
20 — Electrical Resistance ometer, combined with e push button switch as- mounted on bakelite contained in metal case. conditioning systems in gs, etc.

1—Thermostat Box, heated ally, controlled automati- Provides the visible auto- system of thermocouple d error correction.

22—Enclosed Type Switch, pole rotary switch with ts and off position.



23 — Elmendorf Tearing determ nes tearing of paper and allied Works entirely by Gives readings in force required to tear materials. tearing tester of paper

Fig. 24 — Research Tearing Tester, for research and exploratory work and for tear testing where sensitivity desired is finer than calibration of standard Elmendorf Tester.

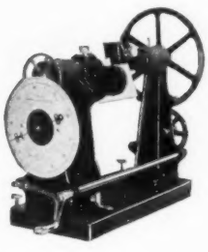


Fig. 25—Initial Tear Tester, measures the initial force required to start a tear. Direct reading, resistance to beginning of tear is indicated in force pounds. Especially suitable for testing box board, roofing felts, floor coverings, gasket papers, etc.

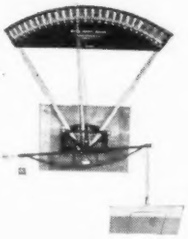


Fig. 26—Basis Weight Scale, reads directly from a single sheet number of pounds per ream of paper. Ranges furnished for a variety of weights. Suitable for moisture content determinations.

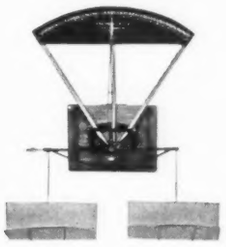


Fig. 27—Differential Scale, determines the weight of material used in coating or treating paper. Readings give weight per ream of material used in treating the paper.

Fig. 28—Electro-Hydraulic Tensile Tester for Testing Paper, Textiles, Tape and Fine Wire. Tensile and elongation tests conform to A.S.T.M. and T.A.P.P.I. official testing methods. Operated by electro-hydraulic power, self-contained. Can be furnished with graphic recording device.

Fig. 29 — McLaurin Gummed Tape Tester, determines critical strength of glue. Measures and indicates resistance value of glue just prior to setting.

Fig. 30—Penescope, for testing paper and other materials for permeability to solutions. Provides visual method for penetration testing.
Also, Water Jacketed Penescope, with equipment to make penetration tests under controlled temperature conditions.

Fig. 31—Carlson Score Tester, tests fiber board at the scoring or crease by subjecting to combined tearing, bending and tensile test.

Fig. 32—Clark Paper Stiffness Tester, determines stiffness or softness of paper. Research Tester shown has rollers to adjust length of sample.
Routine Tester has snap clamp for stiffness or softness tests on samples of specified length.

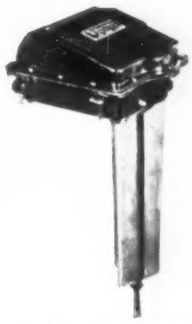
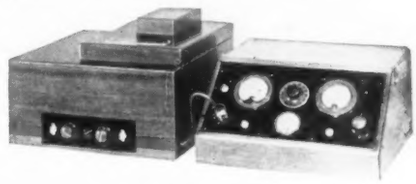


Fig. 33—White Water Sampler, takes samples of waste water automatically, has metered orifice, samples proportional to the flow. Operated electrically.

Fig. 34—Formation Tester, (below), measures objectively quality of paper known as Formation. Test sample in scanning mechanism moved at high velocity between photo-electric cell and light source. Variations in paper structure determined electrically. Reading on meter gives formation number.



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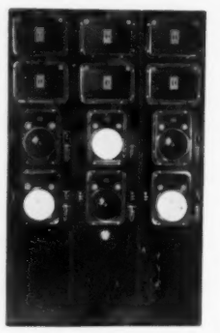

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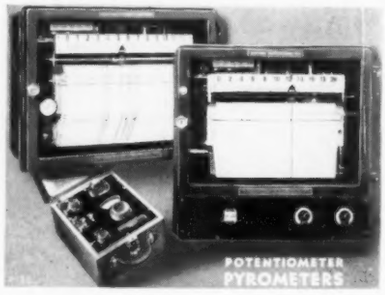

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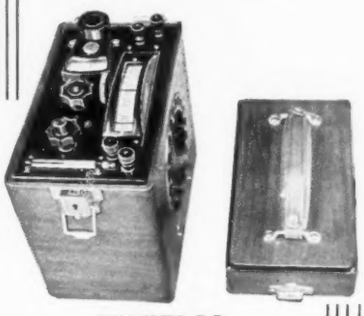

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Morey & Jones, Ltd.
Republic Flow Meters
Tagliabue Mfg. Co.
Taylor Inst. Cos.

PRESSURE RECORDERS, Bourdon tube
Bailey Meter Co.
Baldwin-Southwark Corp.
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft Hancock
Dickson Co.
Esterline-Angus Co.
Foxboro Co.
Improved Gauge Mfg. Co.
Kenyon Instrument Co.
Leeds & Northrup Co.
Marsh Corp., Jas. P.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Republic Flow Meters
Star Brass Mfg. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thrush & Co., H. A.

PRESSURE RECORDERS, Capsular spring
Tagliabue Mfg. Co.

PRESSURE RECORDERS, Diaphragm
Bailey Meter Co.
Brown Inst. Co.
Foxboro Co.
Dickson Co.
Marsh Corp., Jas. P.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Tagliabue Mfg. Co.

PRESSURE RECORDERS, Electrical-resistance
Republic Flow Meters

PRESSURE RECORDERS, Inverted-bell
Bacharach Indus. Inst.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Dickson Co.
Leeds & Northrup Co.
Mason-Neilan Regulator
Taylor Inst. Cos.
Uehling Instrument Co.

PRESSURE RECORDERS, Membrane
Mason-Neilan Regulator

PRESSURE RECORDERS, Piezoelectric
Brush Development Co.
RCA Manufacturing Co.

PRESSURE RECORDERS, Piston, weight-loaded
Bailey Meter Co.

PRESSURE RECORDERS, Single-tube liquid column
Uehling Instrument Co.

PRESSURE RECORDERS, Spring-loaded piston
Bacharach Indus. Inst.
Baldwin-Southwark Corp.
Commercial Engg. Labs.
Esterline-Angus Co.

PRESSURE RECORDERS, U-tube
Bailey Meter Co.
Brown Inst. Co.
Mason-Neilan Regulator
Republic Flow Meters
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Uehling Instrument Co.

PRESSURE SNUBBERS
Binkley, G. S.
Brown Inst. Co.
Martin Decker Corp.
Meriam Co.
Ray Pressure Snubber
Tagliabue Mfg. Co.

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Akatos, Inc.
Alpha Instrument Co.
Clark & Sons
Fish-Schurman Co.
Fecker, J. W.
Fuess, Inc.
Gaertner Scientific Corp.
Goerz Amer. Optical Co.
Kern Co.
Keuffel & Esser Co.
Kollmorgen Optical Co.
Machlett & Son
Master Optical Co.
Perkin, Elmer & Moffitt
Spencer Lens Co.
Valpey Crystals

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PROGRAM CLOCKS (See Timers, Automatic Process)

PROTRACTORS, Bevel (See Drawing Instruments)

PROTRACTORS, Course
Alpha Instrument Co.
Bliss & Co.
Eastern Science Co.
Kenyon Instrument Co.
Keuffel & Esser Co.
Marine Compass Co.
Negus, T. S. & J. D.
Pioneer Instrument Co.
Warren-Knight Co.

PROTRACTORS, Navigators (See Protractors, Course)

PROTRACTORS, Transparent (See Drawing Instruments)

PROVERS, Gas Meter
Lambert Meter Co., Inc.
Pittsburgh Equit. Meter

PROVERS, Water Meter
Pittsburgh Equit. Meter

PROVING RINGS
Baldwin-Southwark Corp.
Holz, Herman A.
Morehouse Machine Co.
Olsen Testing Machine
Pittsburgh Inst. & Mach.

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Batcher, Ralph R.
Brush Development Co.
Electro-Medical Lab.
General Radio Co.
Phipps & Bird, Inc.

PSYCHROMETERS, Aspiration
American Moistening Co.
Friez & Sons
Fuess, Inc.
G. M. Mfg. Co., Inc.
H-B Inst. Co., Inc.
Mason-Neilan Regulator
Moeller Instrument Co.
Palmer Co.

PSYCHROMETERS, Atomizing
Parks-Cramer Co.

PSYCHROMETERS, Electric
American Moistening Co.
Friez & Sons
Fuess, Inc.
G. M. Mfg. Co., Inc.
Leeds & Northrup Co.

PSYCHROMETERS, Recording
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Brown Inst. Co.
Dickson Co.
Foxboro Co.
Friez & Sons
Fuess, Inc.
Leeds & Northrup Co.
Mason-Neilan Regulator
Moeller Instrument Co.
Scientific Inst. Co.
Tagliabue Mfg. Co.

PSYCHROMETERS, Sling
Accuracy Scientific Inst.
American Inst. Co.
American Moistening Co.
Central Scientific Co.
Chicago Apparatus Co.
Foxboro Co.
Fried & Lustig
Friez & Sons
Fuess, Inc.
G. M. Mfg. Co., Inc.
Green, Henry J.
H-B Inst. Co., Inc.
Huddleston, J. S. F.
Johnson Service Co.
Moeller Instrument Co.
Palmer Co.
Parks-Cramer Co.
Phila. Thermometer Co.
Precision Therm. & Inst.
Scientific Inst. Co.
Taylor Inst. Cos.
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Central Scientific Co.
Chicago Apparatus Co.
Distillation Prods., Inc.
Machlett & Son
Refinery Supply Co.
Scientific Glass App.
Sterling Eng. Co.
Welch Mfg. Co.

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Eimer & Amend
Fisher Scientific Co.
Rascher & Betzold
Specialty Glass Co.

PYRHELIOMETERS
Cambridge Inst. Co.
Eppley Lab.
Leeds & Northrup Co.

PYROMETER CALIBRATING SETS
Brown Inst. Co.
Cambridge Inst. Co.
Foxboro Co.
Leeds & Northrup Co.
Lewis Engineering
Rubicon Co.
Tagliabue Mfg. Co.
Thwing-Albert Inst. Co.

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Bailey Meter Co.
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Brown Inst. Co.
Cambridge Inst. Co.
Dickson Co.
Foxboro Co.
General Elec. Co.
Ill. Testing Labs.
Leeds & Northrup Co.
Lewis Engg. Co.
Roller-Smith Co.
Rubicon Co.
Southw'n Electronics Labs.
Tagliabue Mfg. Co.
Thwing-Albert Inst. Co.
Wheelco Inst. Co.

PYROMETERS, Expansion
Defender Automatic Reg.
Ferner Co.
Partlow Corp.
Southw'n Electronics Labs.

PYROMETERS, Indicating
Bacharach Indus. Inst.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Burling Inst. Co.
Electronic Prod. Co.
Engelhard, Chas.
Foxboro Co.
Ill. Testing Labs.
Leeds & Northrup Co.
Lewis Engg. Co.
Partlow Corp.
Pyrometer Inst. Co.

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Southw'n Electronics Labs.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thwing-Albert Instrument
Wheelco Inst. Co.

PYROMETERS, Millivoltmetric
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Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
Engelhard, Chas.
Foxboro Co.
Hoskins Mfg. Co.
Ill. Testing Labs.
Pyrometer Instrument Co.
Rubicon Co.
Southw'n Electronics Labs.
Taylor Inst. Cos.
Thwing-Albert Instrument
Wheelco Inst. Co.

PYROMETERS, Optical
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Brown Inst. Co.
Cambridge Inst. Co.
Fisher Scientific Co.
Leeds & Northrup Co.
Pyrometer Instrument Co.

PYROMETERS, Portable
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Bristol Co.
Cambridge Inst. Co.
Engelhard, Chas.
Foxboro Co.
Hoskins Mfg. Co.
Ill. Testing Labs.
Leeds & Northrup Co.
Lewis Engg. Co.
Pyrometer Instrument Co.
Rubicon Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thwing-Albert Instrument
Wheelco Inst. Co.

PYROMETERS, Potentiometric
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
Dickson Co.
Foxboro Co.
Leeds & Northrup Co.
Lewis Engg. Co.
Rubicon Co.
Southw'n Electronics Labs.
Tagliabue Mfg. Co.
Thwing-Albert Instrument
Wheelco Inst. Co.

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Bacharach Indust. Inst.
Bailey Meter Co.
Brown Inst. Co.
Cambridge Inst. Co.
Engelhard Chas.
Foxboro Co.
General Elec. Co.
Ill. Testing Labs.
Leeds & Northrup Co.
Thwing-Albert Instrument
Wheelco Inst. Co.

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Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
General Elec. Co.
Leeds & Northrup Co.
Pyrometer Instrument Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thwing-Albert Instrument
Wheelco Inst. Co.

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Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
General Elec. Co.
Leeds & Northrup Co.
Pyrometer Instrument Co.
Tagliabue Mfg. Co.
Thwing-Albert Instrument

PYROMETERS, Thermoelectric, Immersion
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Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
General Elec. Co.
Ill. Testing Labs.
Leeds & Northrup Co.
Lewis Engg. Co.
Partlow Corp.
Pyrometer Inst. Co.
Roller-Smith Co.

PYROMETERS, Thermoelectric, Immersion
Southw'n Electronics Labs.
Tagliabue Mfg. Co.
Thwing-Albert Instrument

PYROMETERS, Thermoelectric, Indicating
Am. Gas Furnace Co.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
Foxboro Co.
Hebler Co.
Hoskins Mfg. Co.
Ill. Testing Labs.
Leeds & Northrup Co.
Lewis Engg. Co.
Partlow Corp.
Pyrometer Instrument Co.
Roller-Smith Co.
Rubicon Co.
Scientific Inst. Co.
Southw'n Electronics Labs.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thwing-Albert Instrument
Wheelco Inst. Co.

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Bacharach Indust. Inst.
Bailey Meter Co.
Beck Co.
Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
Engelhard, Chas.
Foxboro Co.
General Elec. Co.
Ill. Testing Labs.
Leeds & Northrup
Lewis Engg. Co.
Mason-Neilan Regulator
Partlow Corp.
Pyrometer Instrument Co.
Southw'n Electronics Labs.
Taylor Inst. Cos.
Thwing-Albert Instrument

PYROMETERS, Thermoelectric, S-face Contact
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Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
Foxboro Co.
General Elec. Co.
Ill. Testing Labs.
Lewis Engg. Co.
Pyrometer Instrument Co.
Southw'n Electronics Labs.
Tagliabue Mfg. Co.
Thwing-Albert Instrument

PYROMETRIC CONES (See Cones, Pyrometric)

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Hanovia Chem. & Mfg.
Thermal Syndicate Ltd.

RACKS, STEEL, For Capacitors, Resistors, Transformers, etc.
Falstrom Co.

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General Elec. Co.

RADIO FREQUENCY METERS (Cont'd)
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Lampkin Laboratories
Rawson Electrical Inst.
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Sensitive Research Inst.
Simpson Elec. Co.
Triplett Electrical Inst.
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RADIO-MICROMETERS Radio) (See Micrometers, Radio)

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McFarlin Co.
RCA Manufacturing Co.
United Cinephone Corp.
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RADIO-MICROMETERS Radio) (See Micrometers, Radio)

RADIO SET ANALYZERS (See Analyzers, Radio Set)

RADIO TEST PANELS (See Panels, Radio Test)

RADIO TUBE CHECKERS (See Checkers, Radio Tube)

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Gurley, W. & L. E.
Keuffel & Esser Co.
Leupold, Volpel & Co.
Precision Therm. & Inst.

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Taylor Inst. Cos.
Warren-Knight Co.
White Co., Inc.
Esterline-Angus Co.
Friez & Sons
Fuess, Inc.
Green, Henry J.
Leupold, Volpel & Co.
Southw'n Electronics Labs.
Taylor Inst. Cos.

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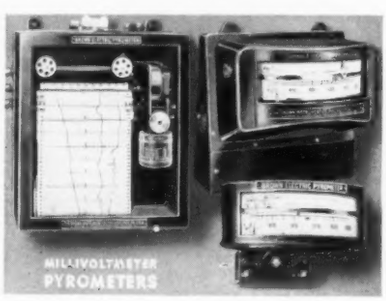
Gaertner Scientific Corp.
Kern Co.
Keuffel & Esser Co.
Kollmorgen Optical Co.
Leitz, Inc.
Precision Therm. & Inst.
White Co., Inc.



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AND
MINNEAPOLIS-HONEYWELL CONTROL SYSTEMS
To Measure and Control is to Economize

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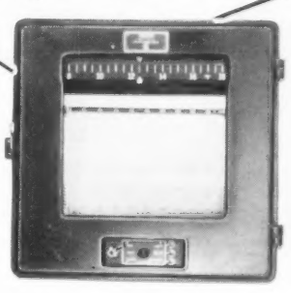
PYROMETERS



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For complete information write for Bulletin No. 190-2. The Foxboro Company, 46 Neponset Avenue, Foxboro, Mass., U. S. A. Branch offices in 25 Principal Cities.

For addresses, see pages 54-58

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REACTANCE METERS
Andrew, Victor J.
General Radio Co.
Premier Crystal Labs.
Rubicon Co.

READING LENSES, Thermometer & Burette (See Lenses, Reading)

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Automatic Electric
Friez & Sons
Mason-Neilan

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Automatic Electric
Bacharach Ind. Inst.
Commercial Eng. Labs.
Foxboro Co.
Friez & Sons
Gaertner Scientific
Simplex Co.
Warren Telechron Co.

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Bristol Co.
Dickson Co.
Foxboro Co.
Friez & Sons
International Filter
Mason-Neilan
Simplex Co.
Tagliabue Mfg. Co.
Warren Telechron Co.

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Brush Development
Commercial Eng. Labs.
Elec. Tachometer Corp.
Esterline-Angus
Foxboro Co.
Friez & Sons
Tagliabue Mfg. Co.
Warren Telechron Co.

RECORDER MECHANISMS, PORTABLE, Tape Chart
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Brush Development Co.
Foxboro Co.
Friez & Sons
Gaertner Scientific
Simplex Co.

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Bristol Co.
Consol. Ashcroft
Dickson Co.
Leeds & Northrup Co.
Simplex Co.
Tagliabue Mfg. Co.

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Elec. Tachometer Corp.
Esterline-Angus
Leeds & Northrup Co.
Mason-Neilan
Tagliabue Mfg. Co.

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B-L Elec. Mfg. Co.
General Elec. Co.
Raytheon Mfg. Co.
Standard Elec. Time
United Transformer Corp.

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Allis-Chalmers Mfg.
Applied Research Labs.
Eclipse Aviation
Electro Products Labs.
General Elec. Co.
Raytheon Mfg. Co.
Southw'n Electronics Labs.
United Transformer Corp.

RECTIFIERS, Thermionic
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Andrew, Victor J.
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DuMont Labs., Inc. A.B.
Electro Products Labs.
Electrons, Inc.
General Elec. Co.
Hy-Ef Elec. Products
Raytheon Mfg. Co.
RCA Manufacturing Co.
Southw'n Electronics Labs.
United Cinephone Corp.
United Transformer Corp.

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Pfaltz & Bauer, Inc.
Southw'n Electronics Labs.

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Leeds & Northrup Co.

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Baird Associates
Bausch & Lomb Optical
Fecker, J. W.
Fish-Schurman Co.
Fuess, Inc.
Perkin, Elmer & Moffitt

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Black-Ray Lighting Co.

REFLECTORS, Concave
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Baird Associates
Bausch & Lomb Optical
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Fuess, Inc.
Perkin, Elmer & Moffitt
Tinsley Labs.

REFLECTORS, First Surface
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Baird Associates
Bausch & Lomb Optical
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Fuess, Inc.
Master Optical Co.
Perkin, Elmer & Moffitt
Tinsley Labs.

REFLECTORS, Heat Resisting
Am. Telescope Labs.
Bausch & Lomb Optical
Fish-Schurman Co.
Fuess, Inc.
Perkin, Elmer & Moffitt

REFLECTORS, Parabolic
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Baird Associates
Bausch & Lomb Optical
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Fuess, Inc.
Perkin, Elmer & Moffitt
Tinsley Labs.
Weber Bros. Metal Works

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Am. Telescope Labs.
Baird Associates
Bausch & Lomb Optical
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Fuess, Inc.
Perkin, Elmer & Moffitt
Tinsley Labs.

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American Telescope Labs.
Bausch & Lomb Optical
Fecker, J. W.
Kollmorgen Optical Co.
Perkin, Elmer & Moffitt

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Bausch & Lomb Optical
Central Scientific Co.
Fuess, Inc.
Industro-Scientific Co.
Spencer Lens Co.
Zeiss, Inc., Carl

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Arca Regulators, Inc.
Askania Regulator Co.
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Bastian-Blessing Co.
Boekel & Co.
Boylston Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Connelly Iron Sponge
Consol. Ashcroft Hancock
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D'Este Co.
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Foster Engg. Co.
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Friez & Sons
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Hagan Corp.
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Hoke, Inc.
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Lammert & Mann Co.
Leslie Co.
Linde Air Products Co.
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McCorkle Co.
Mercon Regulator Co.
National Airoil Burner
Natural Gas Equipment
Northern Equip. Co.
Parks-Cramer Co.
Partlow Corp.
Payne Furnace & Supply
Penn Electric Switch Co.
Pgh. Equitable Meter
Powers Regulator Co.
Preferred Utilities Mfg.
Republic Flow Meters
Reynolds Gas Regulator
Robertshaw Thermostat
R-S Products Corp.
Ruggles-Klingemann
Schade Valve Mfg.
Sprague Meter Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thrush & Co., H. A.
United Cinephone Corp.
Vaughn-G. E. Witt Co.
Victor Equipment Co.
Watts Regulator Co.
White-Rodgers Electric
Wilgus Mfg. Co.

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Foxboro Co.
Mason-Neilan Regulator
Parks-Cramer Co.
Powers Regulator Co.
Robertshaw Thermostat

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Askania Regulator Co.
Bailey Meter Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Connelly Iron Sponge
Eclipse Fuel Engg.
Fisher Governor Co.
Foster Engg. Co.
Foxboro Co.
General Regulator Corp.
Hagan Corp.
Hays Corp.
Hanlon-Waters, Inc.
Mason-Neilan Regulator
McAlear Mfg. Co.
McDonnell & Miller
National Brass Co.
Natural Gas Equipment
Penn Electric Switch
Perfex Corp.
Republic Flow Meters
Robertshaw Thermostat
Ruggles-Klingemann
Tagliabue Mfg. Co.
Thrush & Co., H. A.
Wilgus Mfg. Co.

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Bailey Meter Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Dockson Co.
Electrimatic Corp.
Fisher Governor Co.
Frick Co.
Hanlon-Waters, Inc.
Hoke, Inc.
Linde Air Products Co.
Mason-Neilan Regulator
Mercon Regulator Co.
Natural Gas Equipment
Pgh. Equitable Meter
Republic Flow Meters
Reynolds Gas Regulator
Robertshaw Thermostat
Tagliabue Mfg. Co.
Victor Equipment Co.

REGULATORS, AUTOMATIC, Condensation (See Controllers, Automatic, Condensation)

REGULATORS, AUTOMATIC, Consistency (Paper & Pulp) (See Controllers, Automatic, Consistency)

REGULATORS, AUTOMATIC, Current
Allis-Chalmers Mfg. Co.
Amperite Corp.
Burlington Inst. Corp.
Cutler-Hammer, Inc.

REGULATORS, AUTOMATIC, Current (Cont'd)
General Elec. Co.
Monitor Controller Co.
Robertshaw Thermostat
Roller-Smith Co.
Southw'n Electronics Labs.

REGULATORS, AUTOMATIC, Damper (See Controllers, Automatic, Damper)

REGULATORS, AUTOMATIC, District (See Governors, District)

REGULATORS, AUTOMATIC, Draft (See Controllers, Automatic, Draft)

REGULATORS, AUTOMATIC, Drying Chamber
Powers Regulator Co.
United Cinephone Corp.
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Brown Inst. Co.
Cochrane Corp.
Davis Reg. Co.
Defender Automatic Reg.
Eclipse Fuel Engg. Co.
General Regulator Corp.

REGULATORS, AUTOMATIC, Feed Water
Hagan Corp.
Hanlon-Waters, Inc.
Mason-Neilan Regulator
McAlear Mfg. Co.
McDonnell & Miller
Mercon Regulator Co.
Natural Gas Equipment
Northern Equip. Co.
Ruggles-Klingemann
Stets Co.
Tagliabue Mfg. Co.
Thrush & Co., H. A.
Vaughn-G. E. Witt Co.
Watts Regulator Co.
Wilgus Mfg. Co.
Williams Gauge Co.

REGULATORS, AUTOMATIC, Flow (See Controllers, Automatic, Flow)

REGULATORS, AUTOMATIC, Flow Proportioning (See Controllers, Automatic, Flow Proportioning)

REGULATORS, AUTOMATIC, Fluid Proportioning (See Controllers, Automatic, Fluid Proportioning)

REGULATORS, AUTOMATIC, Frequency
Burlington Inst. Corp.
General Elec. Co.
Warren Telechron Co.
Wheelco Inst. Co.

REGULATORS, AUTOMATIC, Furnace (See Controllers, Automatic, Furnace)

REGULATORS, AUTOMATIC, Gas (See Regulators, Automatic, Air)

REGULATORS, AUTOMATIC, Humidity (See Controllers, Automatic, Humidity)

REGULATORS, AUTOMATIC, Liquid Level (See Controllers, Automatic, Liquid Level)

REGULATORS, AUTOMATIC, Load
Allis-Chalmers Mfg. Co.
Autom'c Valve Controller
Hays Corp.
Leeds & Northrup Co.

REGULATORS, AUTOMATIC, Oil Feed
Askania Regulator Co.
Atlas Valve Co.
Brown Inst. Co.
Cash Co.
D'Este Co.
Foster Engg. Co.
General Regulator Corp.
Hagan Corp.
Lammert & Mann Co.
Mason-Neilan Regulator
McCorkle Co.
National Airoil Burner
Republic Flow Meters
Spence Engineering Co.
Taylor Inst. Cos.
United Cinephone Corp.
Vaughn-G. E. Witt Co.
Wilgus Manufacturing

REGULATORS, AUTOMATIC, Power Factor
Allis-Chalmers Mfg. Co.
Leeds & Northrup Co.
United Cinephone Corp.

REGULATORS, AUTOMATIC, Pressure (See Controllers, Automatic, Pressure)

REGULATORS, AUTOMATIC, Pump
Allen-Bradley Co.
Arca Regulators, Inc.
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Belfield Co.
Boylston Co.
Brown Inst. Co.
Builders Iron Foundry
Cash Co.
Davis Reg. Co.
D'Este Co.
Fisher Governor Co.
Ford Reg. Valve Co.
Foster Engg. Co.
Furnas Electric Co.
General Regulator Corp.
Hagan Corp.
Hanlon-Waters, Inc.
Hydraulic Press Co.
Kliptel Mfg. Co.
Leslie Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Mercon Regulator Co.
Northern Equip. Co.
Penn Electric Switch
Republic Flow Meters
Water Level Controls Co.
Schade Valve Mfg. Co.
Spence Engineering Co.
Tagliabue Mfg. Co.
Vaughn-G. E. Witt Co.
Watts Regulator Co.
Wilgus Mfg. Co.

REGULATORS, AUTOMATIC, Refrigeration (See Controllers, Automatic, Refrigeration)

REGULATORS, AUTOMATIC, RKVA
Allis-Chalmers Mfg. Co.

REGULATORS, AUTOMATIC, Safety Fuel Shut-Off (See Valves, Automatic, Safety Fuel Shut-Off)

STABILIZED VOLTAGE
RAYTHEON VOLTAGE REGULATORS
are magnetic devices without moving parts or adjustments which automatically stabilize AC voltages to plus or minus 1%
SOME BENEFITS OF STABILIZED VOLTAGE
Factory Test Equipment—eliminates manual voltage adjustments
Amplifiers and Rectifiers—makes AC fluctuations unimportant
Laboratories — holds AC voltage constant during tests
Photo-cell Light sources—stabilizes illumination
X-ray Tubes—holds filament emission constant
Pirani Gauges—permits AC operation
WRITE FOR NEW Bulletin DL 48-71G19
RAYTHEON MFG. CO.
WALTHAM, MASS.

For addresses, see pages 54-58

REGULATORS, AUTOMATIC, Speed (See Controllers, Automatic, Speed)

REGULATORS, AUTOMATIC, Steam (See Regulators, Automatic, Pressure)

REGULATORS, AUTOMATIC, Steam Pressure (See Regulators, Automatic, Pressure)

REGULATORS, AUTOMATIC, Synchronizing
Allis-Chalmers Mfg. Co.
Industrial Engr. Corp.
Magnetic Gauge Co.

REGULATORS, AUTOMATIC, Temperature (See Controllers, Automatic, Temperature)

REGULATORS, AUTOMATIC, Time (See Controllers, Automatic, Time)

REGULATORS, AUTOMATIC, Vacuum (See Controllers, Automatic, Vacuum)

REGULATORS, AUTOMATIC, Viscosity (See Controllers, Automatic, Viscosity)

REGULATORS, AUTOMATIC, Voltage
Allis-Chalmers Mfg. Co.
American Transformer
Amperite Corp.
Burlington Inst. Corp.
Clarostat Mfg. Co.
Eclipse Aviation
Electronic Prod. Co.
General Elec. Co.
Ideal Commutator Dresser
International Resistance
Luxtrol Co., Inc.
Miller Co., Bertrand F.
Raytheon Mfg. Co.
Roller-Smith Co.
Southw'n Electronics Labs.
Tagliabue Mfg. Co.
United Cinephone Corp.
United Transformer Corp.
Ward Leonard Elec. Co.

REGULATORS, AUTOMATIC, Water Pressure (See Regulators, Automatic, Pressure)

REGULATORS, AUTOMATIC, Welding, Gas
Bastian-Blessing Co.
Dockson Co.
Victor Equipment Co.

REGULATORS, MANUAL (Non-Automatic)
Allen-Bradley Co.
Bailey Meter Co.
Bellfield Co.
Brown Inst. Co.
Cutler-Hammer, Inc.
Hanlon-Waters, Inc.
National Airoil Burner
National Elec. Controller
Standard Elec. Prods.
Tagliabue Mfg. Co.
United Transformer Corp.
Ward Leonard Elec. Co.

RELAYS, Automatic
Allen-Bradley Co.
American Inst. Co.
American Automatic Elec.
Autocall Co.
Clare & Co.
Cutler-Hammer, Inc.
Eclipse Aviation
General Controls Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Hagan Corp.
Industrial Eng. Corp.
Kellogg Switchboard
Mercoid Corp.
Monitor Controller Co.
Paragon Electric Co.
Penn Electric Switch
Perfex Corp.
Southw'n Electronics Labs.
Struthers Dunn
Thrush & Co., H. A.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

RELAYS, Capacity-Operated
Electronic Lab.
Luxtrol Co., Inc.
Southw'n Electronics Labs.

RELAYS, Circuit Control
Advance Electric Co.
Allen-Bradley Co.
American Automatic Elec.
(Continued on next page)

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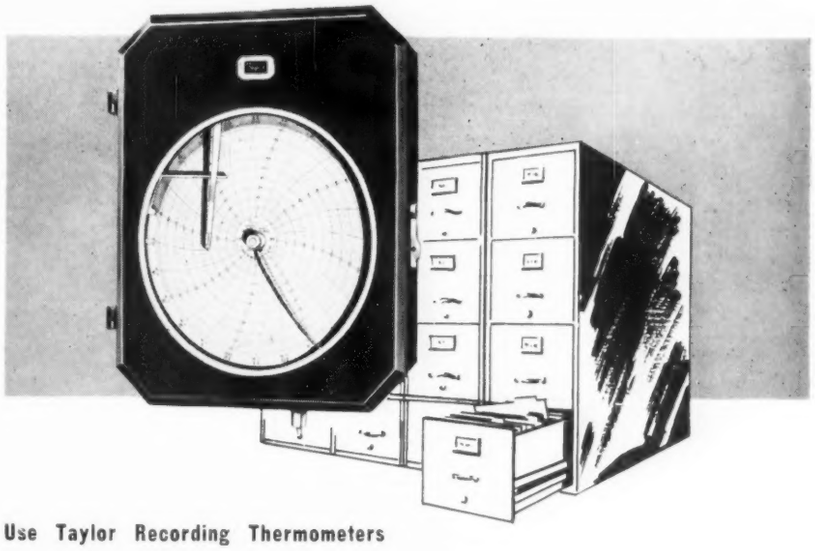

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IN every major industry, Taylor Recording Thermometers have set standards of accurate measurement. Modern, attractive in appearance and troublefree in service, they are used for any application within the temperature limits of minus 100° and plus 1200° F. Accuracy and long life are assured by simple, precise mechanism. Taylor Recording Thermometers are available in mercury-actuated, vapor-actuated, and gas-actuated types. When the mercury-actuated type is used with mercury tube system, Taylor Accuratus Tubing assures accurate records by compensating for temperature fluctuations between bulb and recorder.

Taylor Rectangular Case Recording Thermometers come with one pen, two pens, and three pens, for one or two temperature records and combination of temperature and pressure. Cases face-mounted or flush-mounted. For full information, get in touch with the Taylor Representative or send for latest catalog. Taylor Instrument Companies, Rochester, New York. Plant also in Toronto, Canada.

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The Type "TH" Transtat is the new continuously variable auto-transformer regulator . . . the ideal voltage control for a.c. circuits. It offers high efficiency, good regulation, great flexibility and dependable construction at moderate cost. Standard types are available for controlling voltage to single-phase and polyphase loads rated 10 Kva. and smaller, 50 or 60 cycles, 115, 230 or 460 volts. May we send you bulletin 51-1 which contains complete data?

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VOLTAGE REGULATORS

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178 Emmet St. Newark, N. J.

BURLINGTON VOLTAGE REGULATORS

Are used by the Civil Aeronautics Authority on its full Automatic Emergency Power Plants for Airway Radio Stations.

Are used on power plants of scientific expeditions.

Are used by Engine and Generator Manufacturers, Isolated Power Plants and Industrial Plants throughout the United States, in Canada, and in Mexico.

BURLINGTON INSTRUMENT CORPORATION
BURLINGTON, IOWA

For addresses, see pages 54-58

BULLETIN 81 Intermediate duty
BULLETIN 106 Light duty
BULLETIN 131 Heavy duty
BULLETIN 251 Sensitive type
BULLETIN 351 Thermal time delay
BULLETIN 362 Motor driven time delay

must be DEPENDABLE

Every user of a relay points to his application as the one place where dependability is paramount. The fact is, a relay is a control device and therefore the functioning of the entire equipment with which it is used, depends upon the relay. Ward Leonard recognizes the responsibility placed upon relays today and produces both relays and relay control assemblies that are the utmost in dependability, positive function and long life. Send for bulletins of interest.

WARD LEONARD
ELECTRIC COMPANY
38 South Street, Mount Vernon, N. Y.
ELECTRIC CONTROL DEVICES SINCE 1892

RELAYS, Circuit Control
(Cont'd)
American Inst. Co.
Autocall Co.
Automatic Switch Co.
Brown Inst. Co.
Clare & Co.
Electric Controller
Friez & Sons
General Elec. Co.
Guardian Elec. Mfg. Co.
H-B Inst. Co., Inc.
Kellogg Switchboard
Leach Relay Co.
Lumenite Elec. Co.
Miller Co., Bertrand F.
Monitor Controller Co.
Paragon Electric Co.
Sigma Instruments, Inc.
Standard Elec. Prods.
Struthers-Dunn
Thrush & Co., H. A.
United Cinephone Corp.
Ward Leonard Elec. Co.
Western Electro-Mech.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

RELAYS, Continuous Current
Allen-Bradley Co.
American Automatic Elec.
American Inst. Co.
Autocall Co.
Clare & Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
H-B Inst. Co., Inc.
Kellogg Switchboard
Paragon Electric Co.
Struthers-Dunn
Thrush & Co., H. A.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

RELAYS, Control
Allen-Bradley Co.
Advance Electric Co.
American Automatic Elec.
American Inst. Co.
Autocall Co.
Automatic Switch Co.
Brown Inst. Co.
Clare & Co.
Cutler-Hammer, Inc.
Electric Controller
Friez & Sons
General Controls Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Hagan Corp.
H-B Inst. Co., Inc.
Industrial Eng. Corp.
Kellogg Switchboard
Miller Co., Bertrand F.
Monitor Controller Co.
Perfex Corp.
Precision Therm. & Inst.
Roller-Smith Co.
Standard Elect. Prods.
Struthers-Dunn
United Cinephone Corp.
Ward Leonard Elec. Co.
Western Electro-Mech.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

RELAYS, Demand Totalizing
Autocall Co.
General Elec. Co.
Hagan Corp.
United Cinephone Corp.
Westinghouse Elec. & Mfg.

RELAYS, Electro-Magnet
Advance Electric Co.
Allen-Bradley Co.
American Automatic Elec.
American Inst. Co.
Autocall Co.
Automatic Switch Co.
Clare & Co.
Cutler-Hammer, Inc.
Friez & Sons
General Elec. Co.
G-M Labs.
Guardian Elec. Mfg. Co.
H-B Inst. Co.
Industrial Eng. Corp.
Kellogg Switchboard
Kurman Electric Co.
Leach Relay Co.
Miller Co., Bertrand F.
Monitor Controller Co.
Penn Electric Switch Co.
Perfex Corp.
Phila. Thermometer Co.
Precision Therm. & Inst.
Sigma Instruments, Inc.
Standard Elect. Prods.
Struthers-Dunn
United Cinephone Corp.
Ward Leonard Elec. Co.
Western Electro-Mech.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.
White-Rodgers Electric
Zenith Electric Co.

RELAYS, Heavy Duty
Allen-Bradley Co.
American Automatic Elec.
American Inst. Co.
Autocall Co.
Automatic Switch Co.
Cutler-Hammer, Inc.
General Elec. Co.
H-B Inst. Co., Inc.
Miller Co., Bertrand F.
Monitor Controller Co.

RELAYS, Heavy Duty
(Cont'd)
Penn Electric Switch
Philadelphia Thermometer
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.
Zenith Electric Co.

RELAYS, Instrument Controlled
American Automatic Elec.
American Inst. Co.
Autocall Co.
Brown Inst. Co.
Clare & Co.
Cramer & Co., Inc.
Friez & Sons
General Elec. Co.
Guardian Elec. Mfg. Co.
H-B Inst. Co., Inc.
Kurman Electric Co.
Perfex Corp.
Phila. Thermometer Co.
Precision Therm. & Inst.
Roller-Smith Co.
Southw'n Electronics Labs
Struthers-Dunn
Triplett Electrical Inst.
United Cinephone Corp.
Ward Leonard Elec. Co.
Weston Elec. Inst. Corp.

RELAYS, Light Sensitive (See Photoelectric below)

RELAYS, Magnetic (See Relays, Electro-Magnet)

RELAYS, Mercury
American Automatic Elec.
American Inst. Co.
Autocall Co.
Continental Elec. Co.
H-B Elec. Co., Inc.
H-B Inst. Co., Inc.
Loewenberg, F.
Precision Therm. & Inst.
Weston Elec. Inst. Corp.

RELAYS, Mercury Tube
American Inst. Co.
Autocall Co.
Brown Inst. Co.
Clare & Co.
General Control Co.
G-M Labs.
Guardian Elec. Mfg. Co.
H-B Elec. Co., Inc.
H-B Inst. Co., Inc.
Loewenberg, F.
Phila. Thermometer Co.
Precision Therm. & Inst.

RELAYS, Mercury Tube
(Cont'd)
Steele, Erick F.
Struthers-Dunn
Ward Leonard Elec. Co.
Weston Elec. Inst. Corp.

RELAYS, Motor Driven Time Delay
Advance Electric Co.
American Inst. Co.
Cramer & Co., Inc.
Southw'n Electronics Labs
Struthers-Dunn
Friez & Sons
General Elec. Co.
Industrial Eng. Corp.
Monitor Controller Co.
Paragon Electric Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.
Zenith Electric Co.

RELAYS, Movable Coil A.C.
Esterline-Angus Co.
Etna Elec. Works
General Elec. Co.
Weston Elec. Inst. Corp.

RELAYS, Overload
Allen-Bradley Co.
Autocall Co.
Cutler-Hammer, Inc.
Electric Controller
General Elec. Co.
Guardian Elec. Mfg. Co.
Leach Relay Co.
Penn Electric Switch
Roller-Smith Co.
Standard Elect. Prods.
Struthers-Dunn
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.

RELAYS, Permanent Magnet Movable Coil
Esterline-Angus Co.
Etna Elec. Works
General Elec. Co.
Triplett Electrical Inst.
Weston Elec. Inst. Corp.

RELAYS, Photoelectric
Advance Electric Co.
American Inst. Co.
Clare & Co.
Continental Elec. Co.
Cutler-Hammer, Inc.
Dickson Co.
Electronic Lab.
Electronic Prod. Co.
Ess Instrument Co.

★NOW—Ohmite provides perfect protection against humidity, salt air and other severe atmospheric conditions—insures sustained accuracy and trouble-free life. These new precision units are pie-wound and enclosed in strong glass tubes with the terminals emerging through vacuum-tight glass seals. Ideal for laboratory and test equipment as well as all other applications, particularly in industrial, coastal, marine and tropical locations. Non-inductive winding. Resistance 0.1 ohm to 2 megohms. 1 watt rating—1% accurate (or closer tolerances when required). Provided with soldering lugs and wire terminals or with tube base. Write today for complete information.

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4826 West Flournoy Street, Chicago, U.S.A.

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RHEOSTATS • RESISTORS • TAP SWITCHES

Foxboro Pneumatic Remote Flow Control and Measurement is a simple system which permits location of control in the receiving instrument without loss of power. Standard Foxboro instruments are used throughout. Receivers may be Indicators, Recorders or Recorder-Controllers.

In addition to the pneumatic, Foxboro offers electric distance transmission. For information on both systems write for DMF 714 and DMF 727. The Foxboro Company, 46 Neponset Avenue, Foxboro, Mass., U. S. A. Branch offices in 25 Principal Cities.

For addresses, see pages 54-58

RELAYS, Photoelectric (Cont'd)
Etna Elec. Works
General Controls Co.
General Elec. Co.
G-M Labs.
Leach Relay Co.
Lipman Engg. Co.
Lumenite Elec. Co.
Luxtrol Co., Inc.
Photobell Corp.
Photoswitch, Inc.
Precision Therm. & Inst.
Sigma Instruments, Inc.
Southw'n Electronics Labs
United Cinephone Corp.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

RELAYS, Polarized
American Automatic Elec.
Autocall Co.
Edison Electrical Controls
L. A. B. Corp.
Miller Co., Bertrand F.
Precision Therm. & Inst.
Struthers-Dunn
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

RELAYS, Power
American Automatic Elec.
American Inst. Co.
Automatic Switch Co.
Esterline-Angus Co.
General Controls Co.
General Elec. Co.
Hagan Corp.
Struthers-Dunn
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

RELAYS, Power Factor
Esterline-Angus Co.
L. A. B. Corp.
Westinghouse Elec. & Mfg.

RELAYS, Telephone Auxiliary Ringing
Advance Electric Co.
American Automatic Elec.
Autocall Co.
Clare & Co.
Kellogg Switchboard
Kurman Electric Co.
Leach Relay Co.
Standard Elect. Prods.
Struthers-Dunn
Western Electro-Mech.

RELAYS, Thermal Time Delay
Advance Electric Co.
Allen-Bradley Co.
American Automatic Elec.
Am. Gas Accumulator
American Inst. Co.
Autocall Co.
Automatic Temp. Control
Cramer & Co., Inc.
Cutler-Hammer, Inc.
Eagle Signal Corp.
Edison Electrical Controls
Electric Controller
Electronic Prod. Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Industrial Eng. Corp.
Loewenberg, F.
Luxtrol Co., Inc.
Magnetic Gauge Co.
Paragon Electric Co.
Perfex Corp.
Photobell Corp.
Precision Therm. & Inst.
Preferred Utilities Mfg.
Spencer Thermostat Co.
Standard Elect. Prods.
Struthers-Dunn
Ward Leonard Elec. Co.
Thrush & Co., H. A.
Ward Leonard Elec. Co.
Weston Elec. Inst. Corp.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.
White-Rodgers Electric
Zenith Electric Co.

RELAYS, Time Delay (See Relays, Thermal Time Delay)

RELAYS, Transformer (Low Voltage)
Allen-Bradley Co.
Eclipse Aviation
Friez & Sons
General Controls Co.
Gleason-Avery, Inc.
Guardian Elec. Mfg. Co.
H-B Inst. Co., Inc.
Industrial Eng. Corp.
Miller Co., Bertrand F.
Paragon Electric Co.
Penn Electric Switch
Perfex Corp.
Sigma Instruments, Inc.
Struthers-Dunn
Westinghouse Elec. & Mfg.
White-Rodgers Electric

RELAYS, Vacuum Contact
American Automatic Elec.
American Inst. Co.

RELAYS, Vacuum Tube
American Inst. Co.
Continental Elec. Co.
Electro-Medical Lab.
Electronic Prod. Co.
General Controls Co.
General Elec. Co.
G-M Labs.
L. A. B. Corp.
Lumenite Elec. Co.
Luxtrol Co., Inc.
Photobell Corp.
Precision Therm. & Inst.
RCA Manufacturing Co.
Sargent & Co.
Sigma Instruments
Southw'n Electronics Labs
Standard Elect. Prods.
Struthers-Dunn
United Cinephone Corp.

REMOTE-CONTROL EQUIPMENT
Allen-Bradley Co.
American Automatic Elec.
Area Regulators, Inc.
Arkania Regulator Co.
Atlas Valve Co.
Autocall Co.
Bailey Meter Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Clare & Co.
Cutler-Hammer, Inc.
Davis Reg. Co.
Elec. Indicator Corp.
Electrimatic Corp.
Electronic Lab.
Elsbett Mfg. Co.
Foxboro Co.
General Elec. Co.
Hanlon-Waters, Inc.
Hart Mfg. Co.
Hays Corp.
H-B Inst. Co., Inc.
Illinois Eng. Co.
International Filter Co.
Kol'sman Inst. Co.
Kurman Electric Co.
Luxtrol Co., Inc.
Mason-Neilan Regulator
Perfex Corp.
Photobell Corp.
Powers Regulator Co.
RCA Manufacturing Co.
Republic Flow Meters
Scientific Inst. Co.
Southw'n Electronics Labs
United Cinephone Corp.
Zenith Electric Co.

REMOTE-METERING EQUIPMENT, ELECTRICAL
Andrew, Victor J.
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Elec. Indicator Corp.
Elec. Tachometer Corp.
Esterline-Angus Co.
Foxboro Co.
General Elec. Co.
W. & L. E. Gurley
Kellogg Switchboard
Kurman Electric Co.
L. A. B. Corp.
Leeds & Northrup Co.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Republic Flow Meters
Tagliabue Mfg. Co.
Westinghouse Elec. & Mfg.

REMOTE-METERING EQUIPMENT, HYDRAULIC
Brown Inst. Co.
Builders Iron Foundry
International Filter Co.
Leunold, Volpel & Co.
Westinghouse Elec. & Mfg.

REMOTE-METERING EQUIPMENT, PNEUMATIC
American Meter Co.
Bristol Co.
Brown Inst. Co.
Foxboro Co.
Mason-Neilan Regulator

RESISTANCE LOADING EQUIPMENT
Eastern Specialty Co.
Hardwick, Hindle, Inc.
Internat onal Resistance.
Precision Resistor Co.

RESISTANCES
Allen-Bradley Co.
Central Scientific Co.
Clarostat Mfg. Co.
Cutler-Hammer, Inc.
Daven Co.
General Radio Co.
International Resistance
Ohmite Mfg. Co.
Precision Resistor Co.
Sensitive Research Inst.
Shallcross Mfg. Co.

RESISTORS, CARBON COMPRESSION
Allen-Bradley Co.
International Resistance
Le Carbone Co., Inc.
Nat'l Carbon Co., Inc.
Ohio Carbon Co.

(Continued on next page)

MICROHM
PRECISION
Wire Wound Resistors
● THE STANDARD FOR THE PAST TEN YEARS

A complete line, for all requirements. Designed to save production costs.

New conditions call for new types of resistors. We are ready with many new types of resistors to meet your requirements. Send for details.

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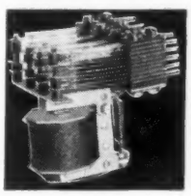
PRECISION RESISTOR COMPANY
330 Badger Avenue
Newark New Jersey

RELAYS by Guardian
For AC or DC Operation

Relays, Solenoids and Stepping Switches illustrated below show just a few of numerous types of electrical control units engineered and manufactured by Guardian Electric. Built by *specialists* in COMPACT and highly sensitive electrical controls, Guardian units possess unusual responsiveness and precision of action. The entire line has been designed and developed for maximum control in minimum space. Guardian Electric controls can be obtained for operation on any specified voltage to 220 DC, 440 AC; on any current from .5 milliampere to 30 amperes; contact capacities to 1600 watts.



Series 30

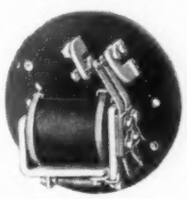
ALTERNATING CURRENT RELAYS

Series 30 (left) Supplied in three types of mountings; voltage range .1 to 440 volts; contact capacity 42 contacts. Size 2⅜x1½x2½.

Series 110 (right) Compact, economical, widely used unit. Four pole, double throw contact capacity. 220 volt limit. Size 2⅜x2⅞x1 15/16".

Series 110

DIRECT CURRENT RELAYS



Series 5

Series 5 (left) Current draw as low as .009 watts—furnished completely enclosed—contact limit, double pole, double throw. Size 3¼x3¼x2".

Series 115 (right) Four pole, double throw contact capacity; rapid change over of contacts, full floating, permanently locked armature, economical of space and cost.

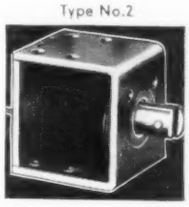
Series 115

S-T-E-P-P-I-N-G RELAYS

Versatile, advanced designs, simple in principle. New applications for these units are appearing constantly giving circuit control hitherto thought impossible. Rigidity of construction guarantees long life. Innumerable variations available.

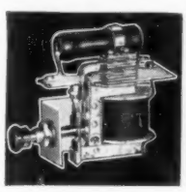
Type-R Stepping Relay

Type No.2



SOLENOIDS—AC; DC

Type No. 2. Efficient—powerful—compact. For electro-mechanical operations involving remote control of mechanical motions such as electric counting, valve control and operation, faulty material ejector, automatic brake, electric racheting, etc. 1½x1½x1⅜.



Overload Relays

Positive, precise protection against current surges, continuous overload. Manual reset. Size 4x2½x3½.

RF Relays Type R-100

Single or double pole, single or double throw, relay with coil wound for 110 volt or 6 volt—60 cycle AC. For high frequency applications.

WRITE TO GUARDIAN for free engineering assistance on any electrical control problem. No obligation. Ask for Big 1939 Catalog L, with illustrations and specifications on our complete line.

GUARDIAN ELECTRIC
1621 W. Walnut St. Chicago • Illinois

For addresses, see pages 54-58

RESISTORS, CARBON COMPRESSION
(Continued)
G. S. Peters
Speer Carbon Co.
Welch Scientific Co.
Eastern Specialty Co.
Hardwick, Hindle, Inc.
International Resistance
Precision Resistor Co.

RHEOSTATS, Battery Charging
Allen-Bradley Co.
Allen Elec. & Equip. Co.
Cutler-Hammer, Inc.
Hardwick, Hindle, Inc.
International Resistance
National Elec. Controller
Ohmite Mfg. Co.
Schaefer Bros. Co.
Ward Leonard Elec. Co.

RHEOSTATS, Field
Allis-Chalmers Mfg. Co.
Cutler-Hammer, Inc.
Eastern Specialty Co.
Elec. Controller & Mfg.
International Resistance
Hardwick, Hindle, Inc.
Monitor Controller Co.
National Elec. Controller
Ohmite Mfg. Co.
Schaefer Bros. Co.
Ward Leonard Elec. Co.

RHEOSTATS, Laboratory
Allen-Bradley Co.
American Inst. Co.
Biddle Co., Jas. G.
Central Scientific Co.
Chicago Apparatus Co.
Eastern Specialty Co.
General Radio Co.
G-M Labs.
Hardwick, Hindle, Inc.
National Elec. Controller
Ohmite Mfg. Co.
Rubicon Co.
Schaefer Bros. Co.
Southw'n Electronics Labs
Ward Leonard Elec. Co.

RHEOSTATS, Meter Testing
Allen-Bradley Co.
Biddle Co., Jas. G. N4
Eastern Specialty Co.
Hardwick, Hindle, Inc.
International Resistance
Leeds & Northrup
National Elec. Controller
Ward Leonard Elec. Co.

RHEOSTATS, Slide Wire
Biddle Co., Jas. G.
Central Scientific Co.
Chicago Apparatus Co.
General Radio Co.
Hardwick, Hindle, Inc.
G-M Labs.
Leeds & Northrup
National Elec. Controller
Rubicon Co.
Shallcross Mfg. Co.
Southw'n Electronics Labs
Ward Leonard Elec. Co.

RIDEOMETERS, RIDE COMFORT RECORDERS & RIDING-QUALITY INSTRUMENTS
Commercial Engg. Labs.
Impact Register Co.
Jaeger Watch Co.
Sperry Products, Inc.

RULES, Adjustable Curve (See Drawing Instruments)

RULES, Aluminum
Keuffel & Esser Co.
Warren-Knight Co.

RULES, Brass
Bliss & Co.
Mico Instrument Co.
Starrett Co.
Warren-Knight Co.

RULES, Caliper
Glogau & Co.
Millers Falls Co.
Starrett Co.
Union Tool Co.
Warren-Knight Co.

RULES, Drafting Room (See Drawing Instruments)

RULES, Folding
Bliss & Co.
Dietzen Co.
Keuffel & Esser Co.
Post Co., Frederick
Speidel & Co.
Starrett Co.
Warren-Knight Co.

RULES, Glass
Fish-Schuman Co.
Glass Engraving Co.
Mico Instrument Co.

RULES, Parallel
Bliss & Co.
Dietzen Co.
Hamilton Mfg. Co.
Keuffel & Esser Co.
Negus, T. S. & J. D.
Speidel & Co.
Warren-Knight Co.
White Co., Inc.
Post Co., Frederick

RULES, Precision Standard
Gaertner Scientific Corp.

RULES, Shrinkage
Keuffel & Esser Co.
Speidel & Co.
Starrett Co.
Warren-Knight Co.

RULES, Slide (See Drawing Instruments)

RULES, Slide, Psychrometric
Friez & Sons

RULES, Steel
Kern Co.
Keuffel & Esser Co.
Mico Instrument Co.
Millers Falls Co.
Scherr Co., Inc.
Speidel & Co.
Starrett Co.
Union Tool Co.
Warren-Knight Co.

RULES, Wood
Henschel & Co.
Keuffel & Esser Co.
Post Co., Frederick
Speidel & Co.
Warren-Knight Co.

RUNNING TIME TOTALIZERS
Cramer & Co., Inc.
Elec. Tachometer Corp.
Jaeger Watch Co.
Production Instrument
Southw'n Electronics Labs

SACCHARIMETERS
Akatos, Inc.
Central Scientific Co.
Eimer & Amend
Moeller Instrument Co.
Sargent & Co.

SACCHAROMETERS
Central Scientific Co.
Eimer & Amend
Fleischhauer & Son
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H.B Inst. Co.
Kimble Glass Co.
Moeller Instrument Co.
Precision Therm. & Inst.
Raschet & Betzold
Ruehfel Co.
Schultheis Corp., E. W.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Wagner & Son

SALINITY INDICATORS
Bendix Marine Products
Central Scientific Co.
Eimer & Amend
Engineering Labs., Inc.
Fleischhauer & Son
G. M. Mfg. Co., Inc.
H-B Inst. Co.
Leeds & Northrup Co.
Precision Therm. & Inst.
Raschet & Betzold
Ruehfel Co.
Schultheis Corp.
Scientific Inst. Co.
Southw'n Electronics Labs
Tagliabue Mfg. Co.
Taylor Inst. Cos.

SALINOMETERS (See Salinity Indicators)

SAMPLER, Boiler Water
Natl. Aluminate Corp.

SAMPLERS, Oil
Braun Corp.
Central Scientific Co.
Pgh. Equitable Meter Refinery Supply Co.
Scientific Glass Apparatus
Tagliabue Mfg. Co.

SAMPLERS, Oil Bottom-hole
Ruska & Co., Inc.

SAMPLERS, Sewage
Builders Iron Foundry
Central Scientific Co.
International Filter Co.
Scientific Glass Apparatus

SAMPLERS, Silt
Central Scientific Co.

SCALES (See also object of measurement and control)

SCALES, Antimony Test
Howe Scale Co.
Seederer-Kohlbusch, Inc.
Troemner, Henry

SCALES, Automatic
Automatic Scale Co.
Buffalo Scale Co.
Chatillon & Sons
Fairbanks, Morse & Co.
Gump Co.
Howe Scale Co.
International Bus. Mach.
Jacobs Bros. Co., Inc.
Kron Co.
Merrick Scale Mfg. Co.
Richardson Scale Co.
Schaffer Poidometer Co.
Streeter-Amet Co.
Toledo Scale Co.
Triangle Package Mach.
Triner Sales Co.

SCALES, Bag Filling
Automatic Scale Co.
Exact Weight Scale Co.
Fairbanks, Moore & Co.
Gump Co.
Jacobs Bros. Co.
Kron Co.
Richardson Scale Co.
Syntron Company
Toledo Scale Co.
Triangle Package Mach.

SCALES, Basis Weight
Amthor Testing Inst. Co.
Becker, Inc., Christian
Buffalo Scale Co.
Exact Scale Co.
Howe Scale Co.
Kron Co.
Seederer-Kohlbusch
Thwing-Albert Instrument
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.

SCALES, Bulk Weighing
Atlas Car & Mfg. Co.
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Jacobs Bros. Co.
Kron Co.
Merrick Scale Mfg.
Richardson Scale Co.
Schaffer Poidometer Co.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.
Triangle Package Mach.
Triner Sales Co.
Troemner, Henry

SCALE, Cement Batching
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Richardson Scale Co.
Streeter-Amet Co.
Toledo Scale Co.
Triner Sales Co.

SCALES, Checking
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Jacobs Bros. Co., Inc.
Kron Co.
Merrick Scale Mfg. Co.
Richardson Scale Co.
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.

SCALES, Classifying
Exact Weight Scale Co.
Jacobs Bros. Co., Inc.
Kron Co.
Toledo Scale Co.
Triner Sales Co.

SCALES, Computing
Amthor Testing Inst.
International Bus. Mach.
Jacobs Bros., Inc.
Toledo Scale Co.
Triner Sales Co.

SCALES, Continuous Weighing
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Gump Co.
Jacobs Bros. Co.
Jeffrey Mfg. Co.
Kron Co.
Merrick Scale Mfg. Co.
Richardson Scale Co.
Schaffer Poidometer Co.
Streeter-Amet Co.
Syntron Company
Toledo Scale Co.
Triangle Package Mach.
United Cinephone Corp.

SCALES, Conveyor
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
International Bus. Mach.
Kron Co.
Merrick Scale Mfg. Co.
Richardson Scale Co.
Schaffer Poidometer Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Counting
Amthor Testing Inst. Co.
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
International Bus. Mach.
Jacobs Bros. Co.
Kron Co.
Seederer-Kohlbusch
Toledo Scale Co.
Triner Sales Co.
United Cinephone Corp.

SCALES, Crane
Buffalo Scale Co.
Chatillon & Sons
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.

SCALES, Dairy
Becker, Inc., Christian
Buffalo Scale Co.
Central Scientific Co.
Chatillon & Sons
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Humboldt Mfg. Co.
International Bus. Mach.
Jacobs Bros. Co.
Kron Co.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.
Troemner, Henry

SCALES, Differential
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Jacobs Bros. Co., Inc.
Kron Co.
Thwing-Albert Instrument

SCALES, Drawing (See Drawing Instruments)

SCALES, Dump
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Toledo Scale Co.

SCALES, Dynamometer
Central Scientific Co.
Chatillon & Sons
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Martin Decker Corp.
Seederer-Kohlbusch, Inc.
Toledo Scale Co.

SCALES, Estimating
Exact Weight Scale Co.
Jacobs Bros. Co.
Seederer-Kohlbusch, Inc.
Troemner, Henry

SCALES, Grain & Seed Testing
Amthor Testing Inst. Co.
Automatic Scale Co.
Becker, Inc., Christian
Buffalo Scale Co.
Central Scientific Co.
Chatillon & Sons
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Fisher Scientific Co.
Gump Co.
Howe Scale Co.
Jacobs Bros. Co.
Kron Co.
Newark Scale Works
Richardson Scale Co.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.
Triangle Package Mach.
Triner Sales Co.
Troemner, Henry

SCALES, Hopper
Atlas Car & Mfg. Co.
Buffalo Scale Co.
Chatillon & Sons
Fairbanks, Morse & Co.
Gump Co.
Howe Scale Co.
Jacobs Bros. Co.
Kron Co.
Richardson Scale Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Laboratory
Becker, Inc., Christian
Buffalo Scale Co.
Central Scientific Co.
Chatillon & Sons
Chicago Apparatus Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Fisher Scientific Co.
Howe Scale Co.
Humboldt Mfg. Co.
International Bus. Mach.
Jacobs Bros. Co.
Microchemical Service
Newark Scale Works
Seederer-Kohlbusch, Inc.
Toledo Scale Co.
Torsion Balance Co.
Troemner, Henry

SCALES, Larry Car
Atlas Car & Mfg. Co.
Buffalo Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Richardson Scale Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Loss of Weight
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale Co.
Jacobs Bros. Co.
Kron Co.
Seederer-Kohlbusch, Inc.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.

SCALES, Measuring
Automatic Scale Co.
Howe Scale Co.
Kron Co.
Richardson Scale Co.
Triner Sales Co.

SCALES, Over & Under
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
International Bus. Mach.
Jacobs Bros. Co.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.
Troemner, Henry

SCALES, Packaging
Automatic Scale Co.
Becker, Inc., Christian
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Gump Co.
Howe Scale Co.
Kron Co.
International Bus. Mach.
Jacobs Bros. Co.
Pneumatic Scale Corp.
Richardson Scale Co.
Toledo Scale Co.
Torsion Balance Co.
Triangle Package Mach.
Triner Sales Co.
Troemner, Henry

SCALES, Platform
Becker, Inc., Christian
Buffalo Scale Co.
Chatillon & Sons
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Gump Co.
Howe Scale Co.
Humboldt Mfg. Co.
International Bus. Mach.
Knowles Scale Works
Kron Co.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.

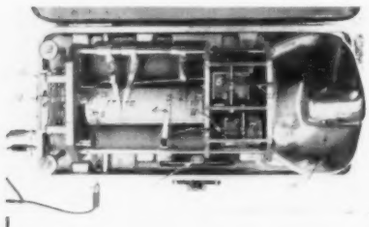
SCALES, Portable
Black & Decker
Buffalo Scale Co.
Central Scientific Co.
Chatillon & Sons
Exact Weight Scale
Fairbanks, Morse & Co.
Gump Co.
Howe Scale Co.
International Bus. Mach.
Jacobs Bros. Co.
Knowles Scale Works
Kron Co.
Richardson Scale Co.
Toledo Scale Co.
Triner Sales Co.

SCALES, Predetermined Weight
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Gump Co.
Howe Scale Co.
International Bus. Mach.
Jacobs Bros. Co.
Merrick Scale Mfg. Co.
Richardson Scale Co.
Schaffer Poidometer Co.
Seederer-Kohlbusch, Inc.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.

SCALES, Recording
Buffalo Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Merrick Scale Mfg. Co.
Richardson Scale Co.
Streeter-Amet Co.
Toledo Scale Co.
Wallace & Tiernan

SCALES, Remote Indicating
Toledo Scale Co.

SCALES, Rolling Mill
Buffalo Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Streeter-Amet Co.
Toledo Scale Co.



THE R-S THREE WAY RIDE RECORDER

Also:

R-S TWO WAY RIDE RECORDERS
SAVAGE IMPACT REGISTERS

R-S TIMERS—for determining speeds of cars before, during and after impact

and . . .

The NEW R-S Draft Gear Action Recorder—stylus connected directly to Coupler Shank Butt records on chart moving 30 inches per second.

Information on request

Impact Register Co.
Champaign, Illinois

For addresses, see pages 54-58

SCALES, Sacking (See Scales, Bag-filling)

SCALES, Selecting
Exact Weight Scale
Toledo Scale Co.
United Cinephone Corp.

SCALES, Solder Test
Central Scientific Co.
Seederer-Kohlbusch, Inc.
Troemner, Henry

SCALES, Steel
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Testing
Becker, Inc., Christian
Buffalo Scale Co.
Gump Co.
Howe Scale Co.
Humboldt Mfg. Co.
Jacobs Bros. Co.
Kron Co.
Newark Scale Works
Toledo Scale Co.
Torsion Balance Co.

SCALES, Textile
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
International Bus. Mach.
Kron Co.
Saxl Instrument Co.
Seederer-Kohlbusch, Inc.
Streeter-Amet Co.
Suter, Alfred
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.

SCALES, Track
Buffalo Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Truck
Black & Becker
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Water Meter
Attender & Sons
Fairbanks, Morse & Co.
Jacobs Bros. Co.
Kron Co.
Toledo Scale Co.

SCALES, Yardage
Am'hor Testing Inst.
Brown & Sharpe
Buffalo Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
International Bus. Mach.
Kron Co.
Toledo Scale Co.

SCREENS, Solar Projecting
Fecker, J. W.

SCREENS, X-Ray Fluoroscopic
General Electric X-Ray
Kelley-Koett Mfg. Co.
Patterson Screen Co.
Westinghouse X-Ray Co.

SCREENS, X-Ray Intensifying (See Screens, X-Ray Fluoroscopic)

SEED SIEVE SETS
Ballauf Mfg. Co.

SEGER CONES (See Cones, Pyrometric)

SEISMOGRAPHS
Akatos, Inc.
Alpha Instrument Co.
American Inst. Co.
Am. Telescope Labs.
Engineering Labs., Inc.
Geophysical Instrument
Helland Research Corp.
Mico Instrument Co.
Ruska & Co., Inc.

SELF-OPERATING CONTROLLERS & REGULATORS AUTOMATIC
Am. Automatic Elec.
American Inst. Co.
Area Regulators, Inc.
Bailey Meter Co.
Brown Inst. Co.
Cutler-Hammer, Inc.
D'Este Co.
Dickson Co.
Elec. Indicator Corp.
Hanlon-Waters, Inc.
Lammert & Mann Co.
Leeds & Northrup Co.
Leslie Co.
Mason-Neilan Regulator
Partlow Corp.
Penn Electric Switch Co.
Perfex Corp.
Ruggles-Klingemann
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
United Transformer

SERVO-MOTORS, Electric Motor
Brown Inst. Co.
Eclipse Aviation
General Regulator Corp.
L. A. B. Corp.

SERVO-MOTORS, Electric Solenoid
Brown Inst. Co.
Eclipse Aviation
Hagan Corp.
Ruggles-Klingemann

SERVO-MOTORS, Hydraulic
Allis-Chalmers Mfg. Co.
Askania Regulator Co.
Eclipse Aviation
General Regulator Corp.
Hagan Corp.
Mason-Neilan Regulator
Ruggles-Klingemann

SERVO-MOTORS, Mechanical
Hagan Corp.

SERVO-MOTORS, Pneumatic
Askania Regulator Co.
Brown Inst. Co.
Hagan Corp.
Mason-Neilan Regulator

SEXTANTS
Alpha Instrument Co.
Kauffel & Esser Co.
Master Optical Co.
Negus, T. S. & J. D.
Pioneer Instrument Co.
Warren-Knight Co.
White Co., Inc.

SHIP LOGS
Elec. Tachometer Corp.
Kenyon Instrument Co.
Negus, T. S. & J. D.
Pitometer Log Corp.

SHUNT METERS (See Meters, Shunt)

SHUNTS
Burton-Rogers Co.
Columbia Elec. Mfg.
Esterline-Angus Co.
General Elec. Co.
Hickok Elec. Inst. Co.
International Resistance
Precision Resistor Co.
Radio City Products Co.
Rawson Electrical Inst.
Roller-Smith Co.
Rubicon Co.
Sensitive Research Inst.
Triplett Electrical Inst.
Westinghouse Elec & Mfg.
Weston Elec. Inst. Corp.

SIEVE SHAKERS
Braun Corp.

SIEVES, TESTING
American Inst. Co.
Central Scientific Co.
Dietert Co.
Fisher Scientific Co.
Humboldt Mfg. Co.
Precision Scientific Co.
Riehle Division
Scientific Inst. Co.
Weber Brothers Metal

SIGHT METERS
General Elec. Co.
G-M Labs
Weston Elec. Inst. Corp.

SIGHTS, GUN, Telescopic
Clark & Sons
Fecker, J. W.
Kollmorgen Optical Co.
Perkin, Elmer & Moffitt
Zeiss, Inc., Carl

SIGNAL GENERATORS (See Generators, Signal)

SIGNALING DEVICES, Automatic
American Automatic Elec.
Autocall Co.
Bullard Co.
Cincinnati Time Rec.
Elec. Indicator Corp.
Foxboro Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
International Bus. Mach.
Leslie Co.
Production Instrument
Southw'n Electronics Labs
Spence Engineering Co.
Thompson Clock Co.
United Cinephone Corp.

SIGNALING DEVICES, Traffic
Am. Gas Accumulator
Bullard Co.
Eagle Signal Corp.
Sangamo Electric Co.
Southw'n Electronics Labs.

SILICA, VITREOUS
Thermal Syndicate, Ltd.

SINE BARS
Ford Motor Co.

SLIDE RULES (See Drawing Instruments)

SLIDING GAGES (See Gages, Sliding)

SLOW MOTION STUDY EQUIPMENT
Annis Co.
Commercial Engg. Labs.
Warren Telechron Co.

SLUMP CONES (See Cones, Slump)

SMOKE DENSITY, Indicators & Recorders
Associated Research
Bailey Meter Co.
Boiler Room Equip.
Bristol Co.
Denver Fire Clay Co.
Dickson Co.
Electronic Lab.
Ess Instrument Co.
General Elec. Co.
General Television Corp.
Leeds & Northrup Co.

SMOKE DENSITY Indicators & Recorders (Cont'd)
Lumenite Elec. Co.
Luxtrol Co., Inc.
McNeill Eng. Equip.
Photobell Corp.
Photoswitch Inc.
Preferred Utilities Mfg.
Southw'n Electronics Labs
United Cinephone Corp.
Weston Elec. Inst. Corp.

SOLAR PROJECTING SCREEN (See Screen, Solar Projecting)

SOUND INDICATORS & ANALYZERS (See Indicators, Sound & Analyzers, Sound)

SOUND LEVEL METERS
Ballantine Labs.
Clough-Brengle Co.
Daven Co.
Electrical Research Prod.
Electronic Design Corp.

SOUND LEVEL METERS
General Elec. Co.
General Radio Co.
Precision Apparatus Corp.
Radio City Products Co.
Shallcross Mfg. Co.
Triplett Electrical Inst.
Weston Elec. Inst. Corp.

SOUNDING LEADS
Ballauf Mfg. Co.
Bliss & Co.
Kenyon Instrument Co.
Moeller Instrument Co.
Negus, T. S. & J. D.

SOUNDING MACHINES
Ballauf Mfg. Co.
Bendix Marine Products
Kenyon Instrument Co.
Moeller Instrument Co.
Negus, T. S. & J. D.
Submarine Signal Co.

SOUNDING TUBES
Ballauf Mfg. Co.
Kimble Glass Co.
Moeller Instrument Co.
Negus, T. S. & J. D.

SPECIFIC GRAVITY, Indicators & Recorders
American Meter Co.
Bailey Meter Co.
Binckley, G. S.
Eimer & Amend

SPECIFIC GRAVITY, Indicators & Recorders (Cont'd)
Foxboro Co.
Refinery Supply Co.
Ruehfel Co.
Schultheis Corp.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.

SPECTRA DEMONSTRATORS
Baird Associates
Central Scientific Co.
Eastern Science Co.
Fuess, Inc.
Gaertner Scientific Corp.

SPECTRAL TUBES CONTAINING RARE GASES (See Spectrum Tubes)

SPECTROGRAPHS
Akatos, Inc.
Bausch & Lomb Optical
Bryden Co.
Gaertner Scientific Corp.
Spencer Lens Co.
Zeiss, Inc., Carl

SPECTROGRAPHS, Diffraction Grating
Applied Research Labs.

SPECTROGRAPHS, Oscillating
Hayes Scientific App.

SPECTROGRAPHS, Vacuum
Baird Associates
Central Scientific Co.
Dietert Co.
Fecker, J. W.
Fuess, Inc.

SPECTROGRAPHS, X-ray
Central Scientific Co.
Fuess, Inc.
Gaertner Scientific
General Electric X-Ray
Hayes Scientific App.
Kelley Koett Mfg.

SPECTROMETERS
Akatos, Inc.
American Askania Corp.
Bausch & Lomb Optical
Fuess, Inc.
Spencer Lens Co.

SPECTROMETER, Infra-Red
Gaertner Scientific Corp.

SPECTROMETERS, X-RAY (See Spectographs, X-Ray)

SPECTRO-PHOTOMETERS (See Photometers, Spectro)

SPECTROSCOPES
Akatos, Inc.
American Askania Corp.
Fuess, Inc.
Gaertner Scientific Corp.
Lentz, Inc.
Spencer Lens Co.

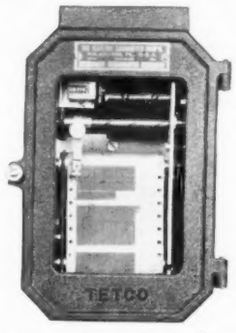
SPECTROSCOPE, Quartz
Gaertner Scientific Corp.

SPECTROSCOPES, Stellar
Am. Telescope Labs.
Central Scientific Co.
Eastern Science Co.
Fecker, J. W.
Mico Instrument Co.
Perkin, Elmer & Moffitt
Zeiss, Inc., Carl

SPECTRUM TUBES
Central Scientific Co.
Fuess, Inc.
Gaertner Scientific Corp.
General Physical Lab.

SPEED, Indicators
Amthor Testing Inst. Co.
Bailey Meter Co.
Biddle Co., Jas. G.
Boulin Instrument Corp.
Brown Inst. Co.
Commercial Engg. Labs.
Consol. Aircraft Hancock
Cramer & Co., Inc.
Electric Speed Ind. Co.
Elec. Tachometer Corp.
Esterline-Angus Co.
Foxboro Co.
Gaertner Scientific Corp.
General Elec. Co.
Hasler-Tel Co.
Hickok Elec. Inst. Co.
Jaeger Watch Co.
Leeds & Northrup Co.
Martin Decker Corp.
McDonnell Odometer Co.
Misener Mfg. Co., Inc.
Precision Therm. & Inst.
Scherr Co., Inc.
Southw'n Electronics Labs
Starrett Co.
Sticht & Co.
Veeder-Root, Inc.
Westinghouse Elec & Mfg.
Weston Elec. Inst. Corp.
Zernickow Co., O.

TETCO
Speed Recorder



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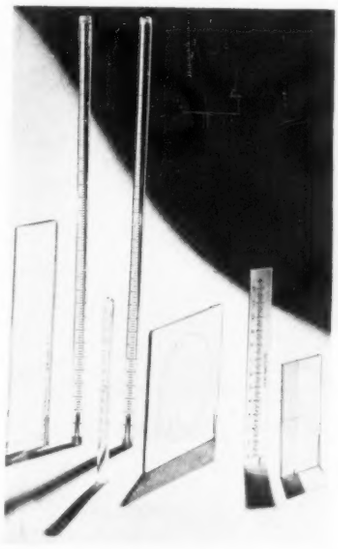

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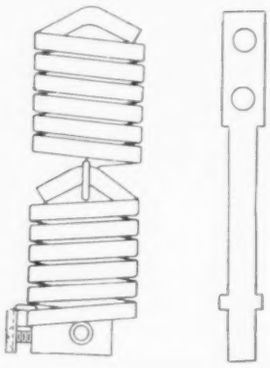
LEOPOLD E. GREINER

also our service for MASS PRODUCTION METHODS and MASS PRODUCTION GLASS ENGRAVING MACHINERY and EQUIPMENT developed for adoption to your particular requirements.

For addresses, see pages 54-58

For Accuracy



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SPEED, Regulators (See Controllers, Automatic, Tachometric)

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SPEEDOMETERS
Boulin Instrument Corp.
Central Scientific Co.
Corbin Screw Corp.
Cramer & Co., Inc.
Elec. Tachometer Corp.
General Elec. Co.
Stewart-Warner Corp.
Westinghouse Elec. & Mfg.

SPHEROMETER
American Askania Corp.
Central Scientific Co.
Fish-Schurman Co.
Fuess, Inc.
Gaertner Scientific Corp.

SPHYGMOMANOMETERS
Cambridge Inst. Co.
Central Scientific Co.
Hellige, Inc.
Precision Therm. & Inst.
Taylor Inst. Cos.

SQUARES, Combination & Machinists'
Brown & Sharpe
Micro Instrument Co.
Starrett Co.
Union Tool Co.
Warren-Knight Co.

STANDARD CELLS (See Cells, Standard)

STANDARDS, Capacitance
Cambridge Inst. Co.
General Radio Co.
Industrial Instruments
Leeds & Northrup Co.
Rubicon Co.
Solar Mfg. Corp.

STANDARDS, Color
Fish-Schurman Co.
Hellige, Inc.
Munsell Color Co.

STANDARDS, E.m.f.
Cambridge Inst. Co.
Leeds & Northrup Co.
Rubicon Co.

STANDARDS, Frequency
Andrew, Victor J.
Ferris Inst. Corp.
General Radio Co.

STANDARDS, Inductance
Cambridge Inst. Co.
General Radio Co.
Leeds & Northrup Co.
Rubicon Co.

STANDARDS, Length
Gaertner Scientific Corp.
Gurley, W. & L. E.
Van Keuren Co.

STANDARDS, Mass
Gurley, W. & L. E.
Seederer-Kohlbusch, Inc.

STANDARDS, Potential
Leeds & Northrup Co.
Rubicon Co.

STANDARDS, Pressure
Green, Henry J.
Holz, Herman A.
Precision Therm. & Inst.

STANDARDS, Resistance
Cambridge Inst. Co.
General Radio Co.
Leeds & Northrup Co.
Rubicon Co.
Shallcross Mfg. Co.
Sticht & Co.

STANDARDS, Sound Level
General Radio Co.

STANDARDS, Temperature
Green, Henry J.
Leeds & Northrup Co.
Moeller Instrument Co.
Precision Therm. & Inst.

STANDARDS, Time
Gaertner Scientific Corp.
General Radio Co.
Standard Elec. Time Co.

STANDARDS, Volume
Gurley, W. & L. E.

STARTERS, MOTOR
Allen-Bradley Co.
Allis-Chalmers Mfg. Co.
Cutler-Hammer, Inc.
Eclipse Aviation
General Elec. Co.
Monitor Controller Co.
Penn Electric Switch Co.
Schaefer Bros. Co.
Ward Leonard Elec. Co.

STATION CONTROL EQUIPMENT
Allis-Chalmers Mfg. Co.
American Meter Co.
Area Regulators, Inc.
Elec. Indicator Corp.
General Elec. Co.

STEAM METERS (See Flow Meters, Steam)

STEEL TAPES (See Tapes, Steel)

STELLAR SPECTROSCOPES (See Spectroscopes, Stellar)

STEREOSCOPES, X-Ray
Bausch & Lomb Optical
Kelley-Koett Mfg. Co.
Westinghouse X-Ray Co.

STETHOSCOPES, ENGINEERS
Brush Development Co.
Sou'hw'n Electronics Labs.

STIFFNESS TESTERS, PAPER (See Tester, Stiffness, Paper)

STILLS, AUTOMATIC WATER
Barnstead Still & Steril.
Central Scientific Co.
Fish-Schurman Co.
Specialty Glass Co.
Weber Bros. Metal Works

STIRRERS, LABORATORY, Variable Speed
Eastern Engg. Co.

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STRAIGHT EDGES
Brown & Sharpe
Dietzen Co.
Ford Motor Co.
Keuffel & Esser Co.
George Scherr Co.
Soltmann, Inc.
Speidel & Co.
Warren-Knight Co.
White Co., Inc.

STRAIN GAGES (See Gages, Strain)

STRAIN TESTERS, GLASS (See Testers, Strain (Glass)

STRAIN-TIME RECORDERS
Baldwin-Southwark Corp.
Cambridge Inst. Co.
Holz, Herman A.

STREAM GAGING INSTRUMENTS
Gurley, W. & L. E.
Keuffel & Esser Co.
Morey & Jones, Ltd.

STRESS INDICATORS
Ames Co., B. C.
Baldwin-Southwark Corp.
Cambridge Inst. Co.
Holz, Herman A.
Martin Decker Corp.
Riehle Div.

STRESS-STRAIN, Indicators
Ames Co., B. C.
Baldwin-Southwark Corp.
Holz, Herman A.

STRESS-STRAIN, Recorders
Baldwin-Southwark Corp.
Cambridge Inst. Co.
Holz, Herman A.
Olsen Testing Machine
Riehle Div.

STROBOSCOPES
Commercial Engg. Labs.
L. A. B. Corp.
Welch Mfg. Co.
Westinghouse Elec. & Mfg.
Zeiss, Inc., Carl

SULPHUR BOMBS (See Bombs, Sulphur)

SULPHUR DIOXIDE, Indicators (See Gas Analyzers, Sulphur Dioxide) **Recorders** (See Gas Analyzers, Sulphur Dioxide)

SUNSHINE, Indicators & Recorders
Cambridge Inst. Co.
Esterline-Angus Co.
Friez & Sons
Fuess, Inc.
G. M. Mfg. Co., Inc.
Leeds & Northrup
Luxtrol Co., Inc.
Sou'hw'n Electronics Labs
Taylor Inst. Cos.
White Co. Inc.

SUPERVISORY CONTROL EQUIPMENT
American Automatic Elec.
Autocall Co.
Bristol Co.
Cramer & Co., Inc.
General Elec. Co.
Guardian Elec. Mfg. Co.
Leeds & Northrup Co.
Sou'hw'n Electronics Labs
Tagliabue Mfg. Co.

SURFACE GAGES (See Gages, Surface)

SURFACE PLATES, GLASS
Bausch & Lomb Optical
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Zeiss, Inc., Carl

SURGE CREST AMMETERS (Ammeters, Surge-Crest)

SURGE, Indicators & Recorders
Elec. Indicator Corp.
General Elec. Co.
Esterline-Angus Co.

SURVEYING INSTRUMENTS
Alpha Instrument Co.
Beckman Co.
Berger & Sons
Bliss & Co.
Dietzen Co.
Gurley, W. & L. E.
Kenyon Instrument Co.
Kern Co.
Keuffel & Esser Co.
Kolesch & Company
Leunold, Volmel & Co.
Pittsburgh Inst. & Mach.
Post Co., Frederick
Speedometer Service Co.
Speidel & Co.
J. C. Ulmer Co.
United States Blue Print
Warren-Knight Co.
Weber Co.
Wolte Co. Inc.
Zeiss, Inc., Carl

SURVEYING INSTRUMENTS, Aneroids
Am. Paulin System

SURVEYING INSTRUMENTS, Underground, for wells or bore holes
H. Cole Co.
Driftmeters, Inc.
Engineering Labs., Inc.
Geophysical Inst. Co.
Halliburton Oil Well
Sperry-Sun Well Survey.
Warren-Knight Co.
David White Co. Inc.

SURVEYOR'S CHAINS (See Surveying Instruments)

SWITCHES, Automatic Transfer
Allen-Bradley Co.
Anderson, A. & J. M.
Arrow-Hart & Hegeman
Autocall Co.
Automatic Switch Co.
Cramer & Co., Inc.
Cutler-Hammer, Inc.
General Elec. Co.
Hart Mfg. Co.
Monitor Controller Co.
Ward Leonard Elec. Co.
Zenith Electric Co.

SWITCHES, Instrument
Autocall Co.
Furnas Electric Co.
General Elec. Co.
Kellogg Switchboard
Rubicon Co.
Sensitive Research Inst.
Thwing-Albert Instrument
Triplett Elec. Inst. Co.
Weston Elec. Inst. Corp.

SWITCHES, Magnetic
Allen-Bradley Co.
Arrow-Hart & Hegeman
Autocall Co.
Automatic Switch Co.
Cutler-Hammer, Inc.
General Elec. Co.
Guardian Elec. Mfg. Co.
Hart Mfg. Co.
Industrial Engr. Corp.
Monitor Controller Co.
Penn Electric Switch
Perfex Corp.
Struthers-Dunn
Ward Leonard Elec. Co.
Zenith Electric Co.

SWITCHES, Mercury
Arrow-Hart & Hegeman
Continental Elec. Co.
Elec. Switch Corp.
General Elec. Co.
Gen. Elec. Vapor Lamp
Hart Mfg. Co.

SWITCHES, Pyrometer
Lewis Engg. Co.
Sou'hw'n Electronics Labs
Tagliabue Mfg. Co.
Thwing-Albert Inst. Co.
Weston Elec. Inst. Corp.

SWITCHES, Relay
Allen-Bradley Co.
Andrew, Victor J.
Amer. Automatic Elec.
Arrow-Hart & Hegeman

SWITCHES, Relay (Cont'd)
Autocall Co.
Automatic Switch Co.
Cutler-Hammer, Inc.
Eclipse Aviation
Friez & Sons
General Controls Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Hart Mfg. Co.
Industrial Engr. Corp.
Kellogg Switchboard
Monitor Controller Co.
Penn Electric Switch
Perfex Corp.
Standard Elec. Prods.
Struthers-Dunn
Ward Leonard Elec. Co.
Zenith Electric Co.

SWITCHES, Rotary
Amer. Automatic Elec.
Arrow-Hart & Hegeman
Autocall Co.
Furnas Electric Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Hart Mfg. Co.
Leonard Elec. Mfg. Co.
Lewis Engg. Co.
Rubicon Co.
Sensitive Research Inst.
Shallcross Mfg. Co.
Tagliabue Mfg. Co.
Thwing-Albert Inst. Co.
Triplett Electrical Inst.
Weston Elec. Inst. Corp.

SWITCHES, Snap
Arrow-Hart & Hegeman
Cutler-Hammer, Inc.
General Elec. Co.
Hart Mfg. Co.
Micro Switch Corp.
Perfex Corp.
Ward Leonard Elec. Co.

SWITCHES, Time
American Timer Corp.
Anderson, A. & J. M.
Autocall Co.
Automatic Elec. Mfg.
Cramer & Co., Inc.
Diebold Safe Co.
Eagle Signal Corp.
Frober-Faybor Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Industrial Engr. Corp.
Industrial Instrument Co.
Landis & Gyr, Inc.
Paragon Electric Co.
Penn Electric Switch
Perfex Corp.
Rhodes, Inc., M. H.
Sangamo Electric Co.
States Co.
Thomas Clock Co., Seth
Thompson Clock Co.
Thrush & Co.
Walser Automatic Timer
Ward Leonard Elec. Co.
Zenith Electric Co.

SYNCHRONIZATION FORKS, Electrical (See Forks, Synchronization)

SYNCHRONOUS MOTORS (See Motors, Synchronous)

SYNCHROSCOPES
Allis-Chalmers Mfg. Co.
Eclipse Aviation
Electric Controller
General Elec. Co.
Hickok Elec. Inst. Co.
Kollsman Inst. Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

TACHOGRAPHS
Amthor Testing Inst.
Biddle Co., Jas. G.
Coats Mach. Tool Co.
Cramer & Co., Inc.
Ohmer Register Co.
Zeiss, Inc., Carl
Zernickow Co., O.

TACHOMETER TESTERS (See Testers, Tachometer)

TACHOMETERS, Centrifugal
Amthor Testing Inst. Co.
Barbour Stockwell Co.
Biddle Co., Jas. G.
Boulin Instrument Corp.
Coats Mach. Tool Co.
Consol. Asheroft Hancock
Corbin Screw Corp.
Durant Mfg. Co.
Elec. Tachometer Corp.
Foxboro Co.
Hays Corp.
Jones Motrola Sales
Kollsman Inst. Co.
Pioneer Instrument Co.
Schertz Co., Inc.
Stewart-Warner Corp.
Sticht & Co.
Veeder-Root, Inc.
Viking Instrument Co.
Zernickow Co., O.

For addresses, see pages 54-58

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Boulin Instrument Corp.
Coats Mach. Tool Co.
Cramer & Co., Inc.
Elec. Tachometer Corp.
Elgin Nat'l Watch Co.
Hasler-Tel Co.
Jaeger Watch Co.
Pierce Watch Co.
Scherr Co., Inc.
Standard Elec. Time
Sticht & Co.
Stover-Lang Co.
Zernickow Co., O.

TACHOMETERS, Cross-pendulum
Amthor Testing Inst.
Biddle Co., Jas. G.
Coats Mach. Tool Co.
Sticht & Co.
Zernickow Co., O.

TACHOMETERS, Electric
Allen Elec. & Equip.
Bristol Co.
Brown Inst. Co.
Electric Speed Ind. Co.
Elec. Tachometer Corp.
Esterline-Angus Co.
General Elec. Co.
Hickok Elec. Inst. Co.
Hy-Ef Electrical Prods.
Jaeger Watch Co.
Jones Motrola Sales
Kollsman Inst. Co.
Lantz-Phelps Corp.
Martin Decker Corp.
National Instrument Co.
Pioneer Instrument Co.
Pitometer Log Corp.
Potter Co.
Scherr Co., Inc.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.
Zip Abrasive Co.

TACHOMETERS, Electromagnetic
Cummings Mach. Works
Jaeger Watch Co.
Kollsman Inst. Co.
National Instrument Co.
Standard Elec. Time Co.
Stewart-Warner Corp.
Zernickow Co., O.

TACHOMETERS, Fly-ball
Biddle Co., Jas. G.
Coats Mach. Tool Co.
Elec. Tachometer Corp.
Jones Motrola Sales
Sticht & Co.
Viking Instrument Co.

TACHOMETERS, Portable
Amthor Testing Inst. Co.
Biddle Co., Jas. G.
Boulin Instrument Corp.
Consol. Ashcroft Hancock

TACHOMETERS, Portable (Cont'd)
Corbin Screw Corp.
Elec. Tachometer Corp.
Foxboro Co.
Hasler-Tel Co.
Jones Motrola Sales
Martindale Electric Co.
Sticht & Co.
Viking Instrument Co.

TACHOMETERS, Speed Limit Control
Barbour Stockwell Co.

TACHOMETERS, Stroboscopic
Boulin Instrument Corp.
Coats Mach. Tool
General Radio Co.
L. A. B. Corp.
Stewart-Warner Corp.

TACHOMETERS, Tilting-ring
Amthor Testing Inst. Co.
Coats Mach. Tool Co.

TACHOMETERS, Vibrating Reed
Biddle Co., Jas. G.

TACHOSCOPES
Amthor Testing Inst. Co.
Biddle Co., Jas. G.
Scherr Co., Inc.
Sticht & Co.
Zernickow Co., O.

TAFFRAIL LOGS: SHIP
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TANGENT METERS (See Meters, Tangent)

TAPE STRETCHER APPARATUS
Ballaut Mfg. Co.

TAPES, Oil Gauger's
Keuffel & Esser Co.

TAPES, Steel
Dietzen Co.
Keuffel & Esser Co.
Soltmann, Inc.
Sneidel & Co.
Starrett Co.
United States Blue Print
Warren Knight Co.
White Co., Inc.

TAPES, Surveyor's (See Surveying Instruments)

TAXI METERS
Pittsburgh Taximeter Co.
Ohmer Register Co.

TELEMETERING SYSTEMS (See Remote Metering)

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Kern Co.
Kollmorgen Optical Co.
Keuffel & Esser Co.
Pierce Watch Co.

TELESCOPES, Alignment
Am. Telescope Labs.
Fecker, J. W.
Keuffel & Esser Co.
Kollmorgen Optical Co.
Perkin, Elmer & Moffitt
Scherr Co., Inc.
White Co., Inc.

TELESCOPES, Astronomical
Am. Telescope Labs.
Clark & Sons
Eastern Science Co.
Fecker, J. W.
Gaertner Scientific Corp.
Kern Co.
Micro Instrument Co.
Perkin, Elmer & Moffitt
Tinsley Labs.
Zeiss, Inc., Carl

TELESCOPES, Azimuth
Am. Telescope Labs.
Clark & Sons
Fecker, J. W.
Gaertner Scientific Corp.
Kern Co.
Kollmorgen Optical Co.
Perkin, Elmer & Moffitt
Tinsley Labs.
Warren-Knight Co.
Warner & Swasey Co.
Zeiss, Inc., Carl

TELESCOPES, Bore, Inspection
Am. Telescope Labs.
Kollmorgen Optical Co.
Perkin, Elmer & Moffitt
Scherr Co., Inc.
Zeiss, Inc., Carl

TELESCOPES, Laboratory
Gaertner Scientific Corp.

TELESCOPES, Reflecting
Am. Telescope Labs.
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Perkin, Elmer & Moffitt
Tinsley Labs.
Warner & Swasey Co.
Zeiss, Inc., Carl

TELESCOPES, Refracting
Am. Telescope Labs.
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Kern Co.
Keuffel & Esser Co.
Perkin, Elmer & Moffitt
Tinsley Labs.
Warner & Swasey Co.
Wollensak Optical Co.
Zeiss, Inc., Carl

TELESCOPES, Zenith
American Askania Corp.
Am. Telescope Labs.
Clark & Sons
Fecker, J. W.
Gaertner Scientific Corp.
Kern Co.
Perkin, Elmer & Moffitt
Zeiss, Inc., Carl

TENSIOMETERS
Boulin Instrument Corp.
Central Scientific Co.
Geophysical Inst. Co.
Holz, Herman A.
Olsen Testing Machine
Suter, Alfred
Toledo Scale Co.

TENSION INDICATORS
Martin Decker Corp.
Seederer-Kohlbusch, Inc.

TENSION INDICATORS, Textile
Boulin Instrument Corp.
Holz, Herman A.

TEST BLOCKS
Detroit Testing Mach. Co.
Ford Motor Co.
Holz, Herman A.

TEST BLOCKS (Cont'd)
Meter Devices Co.
Steel City Testing Lab.
Van Keuren Co.

TEST WEIGHTS (See Weights, Test)

TEST WELLS
Palmer Co.

TESTERS & TESTING MACHINES (See also object of measurement and control)

TESTERS & TESTING MACHINES, Abrasion
Amthor Testing Inst. Co.
Atlas Elec. Devices Co.
Fidelity Mach. Co.
Holz, Herman A.
Morehouse Machine Co.
Olsen Testing Machine
Riehle Div.
Saxl Inst. Co.
Shawmut Engineering Co.
Suter, Alfred
Taber Instrument Co.
Testing Machines, Inc.
Zuhr, Inc., Henry

TESTERS & TESTING MACHINES, Absorption
Gurley, W. & L. E.

TESTERS & TESTING MACHINES Air Speed Indicator (See Air-speed Indicator Testers)

TESTERS & TESTING MACHINES, Alternating Stress
Brush Development Co.
Emery Co.
Holz, Herman A.
Krouse Fatigue Machine
Olsen Testing Machine
Riehle Div.
Suter, Alfred

TESTERS & TESTING MACHINES, Altimeter (See Altimeter Testers)

TESTERS & TESTING MACHINES, Armature
Ideal Commutator Dresser

TESTERS & TESTING MACHINES, Asphalt
American Inst. Co.
Braun Corp.
Central Scientific Co.
Chatillon & Sons
Fish-Schurman Co.
Fisher Scientific Co.
Humboldt Mfg. Co.
Philadelphia Thermometer
Precision Scientific Co.
Riehle Div.
Tagliabue Mfg. Co.
Victor Equipment Co.
Western Machinery Co.

TESTERS & TESTING MACHINES, Axle
Sperry Products, Inc.

TESTERS & TESTING MACHINES, Ball Bearing (See Testers, Bearing)

TESTERS & TESTING MACHINES, Battery
Allen Elec. & Equip. Co.
Burton-Rogers Co.
Clough-Brengle Co.
Hickok Elec. Inst. Co.
Hy-Ef Electrical Prods.
Lantz Phelps Corp.
Lundquist Tool & Mfg.
Precision Therm. & Inst.
Raschen & Betzold
Ruth Glass Division
Testrite Instrument Co.
Weston Elec. Inst. Corp.

TESTERS & TESTING MACHINES, Bearing
Holz, Herman A.
Olsen Testing Machine
RCA Manufacturing Co.
Suter, Alfred

TESTERS & TESTING MACHINES, Beating
Green, Arthur B.
Williams Apparatus Co.

TESTERS & TESTING MACHINES, Bending
Dorr-Patterson Engr.
Hayes Scientific Appl.
Olsen Testing Machine
Holz, Herman A.
Morehouse Machine Co.
Riehle Div.
Saxl Inst. Co.
Steel City Testing Lab.
Suter, Alfred
Taber Instrument Co.
Testing Machines, Inc.

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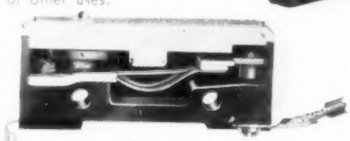

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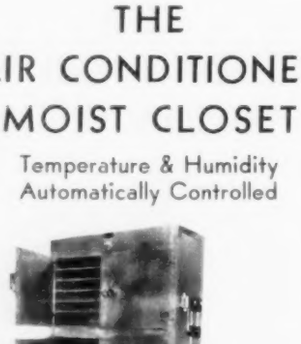

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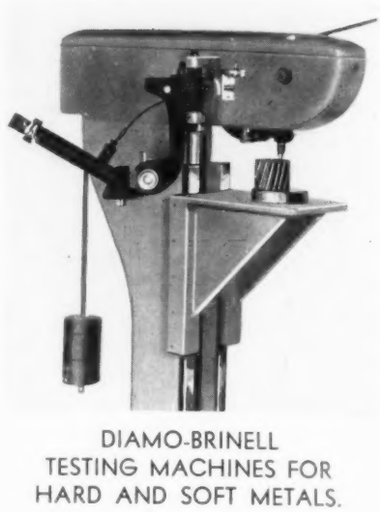

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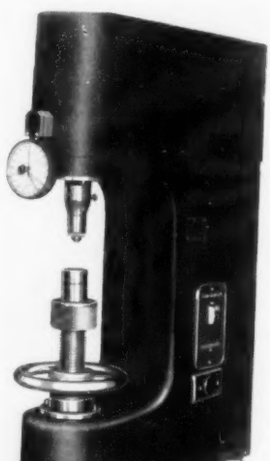

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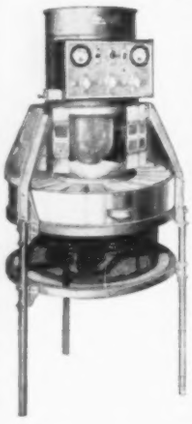

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Holz, Herman A.
Saxl Inst. Co.
Suter, Alfred
Thwing-Albert Inst. Co.

TESTERS & TESTING MACHINES, Torsion
Baldwin-Southwark Corp.
Boulin Instrument Corp.
Detroit Testing Mach.
Emery Co.
Hayes Scientific App.
Holz, Herman A.
Olsen Testing Machine
Riehle Div.
Saxl Inst. Co.
Steel City Testing
Suter, Alfred
Testing Machines Inc.
Toledo Scale Co.

TESTERS & TESTING MACHINES, Torsional Creep
Baldwin-Southwark Corp.
Holz, Herman A.
Suter, Alfred

TESTERS & TESTING MACHINES, Turn Indicator
Amthor Testing Inst. Co.
Ruehfel Co.

TESTERS & TESTING MACHINES, Universal
Amthor Testing Inst. Co.
Detroit Testing Mach.
Holz, Herman A.
Olsen Testing Machine
Riehle Div.
Steel City Testing Lab.

TESTERS & TESTING MACHINES, Vapor Transmission
Thwing-Albert Inst. Co.

TESTERS & TESTING MACHINES, Varnish
Atlas Elec. Devices Co.
Eimer & Amend
Fish-Schurman Co.
Hellige, Inc.
Taber Instrument Co.
Zuhr, Inc., Henry

TESTERS & TESTING MACHINES, Vibration
Brush Development Co.

TESTERS & TESTING MACHINES, Voltage
Allen Elec. & Equip.
Associated Research
Clough-Brengle Co.
General Elec. Co.
Norton Electrical Inst.
Potter Co.
Shallcross Mfg. Co.
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TESTERS & TESTING MACHINES, Water Meter
Badger Meter Co.
Ford Meter Box Co.
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TESTERS & TESTING MACHINES, Water Penetration
Thwing-Albert Inst. Co.

TESTERS & TESTING MACHINES, Watch Rate
Paulson & Co.

TESTERS & TESTING MACHINES, Watthour Meter
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General Elec. Co.
Sangamo Electric Co.
Standard Elec. Time
States Co.
Western Electro-Mech.
Westinghouse Elec. & Mfg.

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Atlas Elec. Devices Co.
Gen. Elec. Vapor Lamp

TESTERS & TESTING MACHINES, Wire
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Baldwin-Southwark Corp.
Holz, Herman A.
Krouse Fatigue Mach.
Olsen Testing Machine
Riehle Div.
Saxl Inst. Co.
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Suter, Alfred
Taber Instrument Co.

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Brown Inst. Co.
Emerson Apparatus Co.
Hays Laboratories
Holz, Herman A.
Saxl Inst. Co.
Suter, Alfred
Testing Machines, Inc.

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For addresses, see pages 54-58

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Olsen Testing Machine
Saxl Inst. Co.

TESTING MACHINES, UNIVERSAL, Dead Weight Beam, Capacities 100-5000 lb.
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Olsen Testing Machine
Riehle Div.
Saxl Inst. Co.
Steel City Testing
Suter, Alfred

TESTING MACHINES, UNIVERSAL, Pendulum, Capacities 100-5000 lb.
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Holz, Herman A.
Olsen Testing Machine
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Holz, Herman A.
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Steel City Testing
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Holz, Herman A.
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TESTING MACHINES, UNIVERSAL, Spring Dynamometer, Capacities over 100,000 lb.
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Gow-Mac Instrument
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Hy-Ef Electrical Prod.
Nicholl & Co.
Potter Co.

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Elec. Facilities Inc.
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West. Electro-Mechanical

TESTING SETS, Electrical
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American Transformer
Associated Research
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Columbia Elec. Mfg.
General Elec. Co.
Industrial Inst. Inc.
Meter Devices Co.
RCA Manufacturing Co.
Rubicon Co.
Shallcross Mfg. Co.
Sticht & Co.
Tobe Deutschmann Corp.
West. Electro-Mechanical
Weston Elec. Inst. Corp.

TESTING SETS, Electrical Thermometer
Brown Inst. Co.
Shallcross Mfg. Co.
Thwing-Albert Instrument

TESTING SETS, Ground Resistance
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Associated Research
Biddle Co., Jas. G.
Industrial Inst., Inc.
Rubicon Co.
Sensitive Research Inst.
Southw'n Electronics Labs
Sticht & Co.

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Associated Research
Columbia Elec. Mfg.
Elec. Facilities, Inc.
General Elec. Co.
Meter Devices Co.
Roller-Smith Co.
West. Electro-Mechanical
Weston Elec. Inst. Corp.

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Eastern Specialty Co.
Elec. Facilities, Inc.
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Sensitive Research Inst.
Shallcross Mfg. Co.
States Co.
Weston Elec. Inst. Corp.

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Brown Inst. Co.
Tagliabue Mfg. Co.

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Dwyer Mfg. Co.
Engelhard, Chas.
Friez & Sons
Gow-Mac Instrument
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TESTING SETS, Potential transformer
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Elec. Facilities, Inc.
Leeds & Northrup Co.
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Industrial Inst., Inc.
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THEODOLITES (See Surveying Instruments)

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Bacharach Industrial Inst.
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(Continued on next page)

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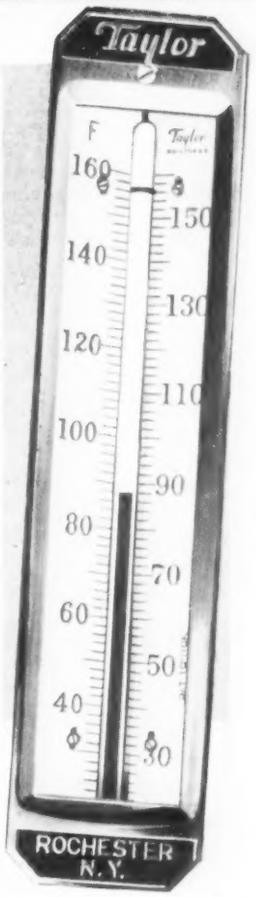

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Bristol Co.
Brown Inst. Co.
Engelhard, Chas.

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General Elec. Co.
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Gow-Mac Instrument
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Rubicon Co.
Shallcross Mfg. Co.
Southw'n Electronics Labs
Tagliabue Mfg. Co.
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H-B Inst. Co., Inc.
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U. S. Gauge Co.
Wagner & Son
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Bristol Co.
Chaslyn Co.
Consol. Ashcroft Hancock
Eimer & Amend
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Fee & Stemwedel
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Taylor offers Round or Octagonal DIAL THERMOMETERS

of proved accuracy and long life

Let us help you select the type best suited to your needs

Taylor Rectangular Case Dial Thermometers, made for quick, accurate temperature taking, have easy-reading scales with large black figures and graduations. Wedge-shaped pointer directs the eye instantly to the temperature indication. They're available in any of the three types of power units — mercury-actuated, vapor-actuated, gas-actuated. For measuring one or two temperatures.

Standard finish of these Taylor Instruments is dull instrument black. White finished cases are also available.

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Taylor

Indicating / Recording • Controlling

TEMPERATURE, PRESSURE, FLOW *and* **LEVEL INSTRUMENTS**

For addresses, see pages 54-58

THERMOMETERS, Indicating Mercury-in-glass (Cont'd)
G. M. Mfg. Co., Inc.
Green, Henry J.
Grebel Instrument Co.
Hays Corp.
H-B Inst. Co., Inc.
Huddleston, J. S. F.
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Kessler Thermometer
Moeller Instrument Co.
Nurnberg Thermometer
Palmer Co.
Paulstich & Sons
Pecorella Mfg. Co.
Phila. Thermometer
Precision Therm. & Inst.
Rascher & Betzold
Roth Glass Division
Schultheis Corp.
Scientific Glass App.
Scientific Inst. Co.
Standard Therm. Corp.
Steele, Erick F.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Western Machinery Co.
Wilder Sales Co.

THERMOMETERS, Indicating, Pressure-spring
Bailey Meter Co.
Bristol Co.
Dickson Co.
Foxboro Co.
Industrial Instrument Co.
King-Seeley Corp.
Liquidometer Co., Inc.
Marsh Corp., Jas. P.
Mason-Neilan Regulator
Moeller Instrument Co.
Partlow Corp.
Powers Regulator Co.
Practical Instrument Co.
Preferred Utilities Mfg.
Republic Flow Meters
Rochester Mfg. Co.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Welch Mfg. Co.

THERMOMETERS, Portable
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft Hancock
Dickson Co.
Engelhard, Chas.
Foxboro Co.
Friez & Sons
Green, Henry J.
Mason-Neilan Regulator
Powers Regulator Co.
Practical Instrument Co.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Wagner & Son
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THERMOMETERS, Recording and/or Controlling, Electrical Resistance
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
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Foxboro Co.
General Elec. Co.
G-M Labs.
Ill. Testing Labs.
Leeds & Northrup Co.
Souchw'n Electronics Labs
Tagliabue Mfg. Co.
Thwing-Albert Instrument

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Foxboro Co.
Friez & Sons
Green, Henry J.
H-B Inst. Co., Inc.
Mason-Neilan Regulator
Moeller Instrument Co.
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Standard Thermometer

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Consol. Ashcraft Hancock
Defender Automatic Reg.
Dickson Co.
Foxboro Co.
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Industrial Inst. Co.
Liquidometer Co.
Mason-Neilan Regulator
Moeller Instrument Co.
Partlow Corp.
Powers Regulator Co.
Practical Instrument Co.
Preferred Utilities Mfg.
Republic Flow Meters
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
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Cambridge Inst. Co.
Eppley Lab.
Gaertner Scientific Corp.
Hoffman Co., S. O.
Leeds & Northrup Co.
Rawson Electric Inst.

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Allen-Bradley Co.
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Steele, Erick F.
Supreme Elec. Prods.
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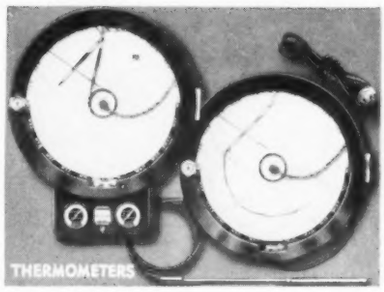

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Souchw'n Electronics Labs
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American Timer Corp.
Coleman Elec. Co.

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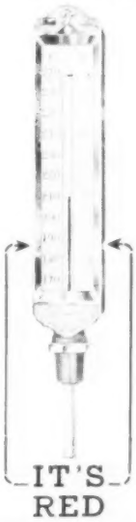

For addresses, see pages 54-58

TIME OPERATION, Indicators
Bristol Co.
Brown Inst. Co.
Elec. Tachometer Corp.
Gaertner Scientific Corp.
General Elec. Co.
Intern'l Business Mach.
Paragon Electric Co.
Southw'n Electronics Labs.
Stromberg Electric Co.
Tagliabue Mfg. Co.
Warren Telechron Co.
Weston Elec. Inst. Corp.

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Automatic Time Stamp
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Brown Inst. Co.
Calculagraph Co.
Cincinnati Time Rec.
Consol. Ashcroft Hancock
Cramer & Co., Inc.
Elec. Tachometer Corp.
Esterline Angus Co.
Gaertner Scientific Corp.
Halpern, Walter J.
Industrial Instrument Co.
Jaeger Watch Co.
Intern'l Business Mach.
Marston Co.
Paragon Electric Co.
Practical Instrument Co.
Production Inst. Co.
Service Recorder Co.
Southw'n Electronics Labs.
Tagliabue Mfg. Co.

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Automatic Time Stamp
Cincinnati Time Rec.
Intern'l Business Mach.
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Am. Gas Accumulator
Automatic Elec. Mfg.
Automatic Temp. Control
Bristol Co.
Cramer & Co., Inc.
Eagle Signal Corp.
Guardian Elec. Mfg. Co.
Intercontinental Mark'ng
Mason-Neilan Regulator
Paragon Electric Co.
Production Inst. Co.
Southw'n Electronics Labs.
Stromberg Electric Co.
Struthers-Dunn

TIMERS, AUTOMATIC, Automatic Reset (Cont'd)
Taylor Inst. Cos.
Warren Telechron Co.
Zenith Electric Co.

TIMERS, AUTOMATIC, Cycle
Am. Gas Accumulator
Autocall Co.
Automatic Temp. Control
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft Hancock
Cramer & Co., Inc.
Eagle Signal Corp.
Elec. Switch Corp.
Hanlon-Waters, Inc.
Industrial Inst. Co.
Luxtrol Co., Inc.
Paragon Electric Co.
Penn Electric Switch
Sangamo Electric Co.
Southw'n Electronics Labs.
Stromberg Electric Co.
Taylor Inst. Cos.
Thomas Clock Co.
Thompson Clock Co.
Walser Automatic Timer
Warren Telechron Co.
West. Electro-Mechanical
Weston Elec. Inst. Corp.
Wheelco Inst. Co.
Zenith Electric Co.

TIMERS, AUTOMATIC, Interval
Am. Gas Accumulator
Am. Timer Corp.
Anderson, A. & J. M.
Automatic Elec. Mfg.
Automatic Temp. Control
Bristol Co.
Cramer & Co., Inc.
Eagle Signal Corp.
Elec. Switch Corp.
Frober-Faybor Co.
General Electric X-Ray
Glogau & Co.
Guardian Elec. Mfg.
Industrial Engr. Corp.
Luers, J. Milton
Measured Time, Inc.
Paragon Electric Co.
Perfex Corp.
Production Inst. Co.
Standard Elec. Time
Stromberg Electric Co.
Struthers-Dunn
Tagliabue Mfg. Co.
Thomas Clock Co.
Thompson Clock Co.
Walser Automatic Timer
Warren Telechron Co.
Zenith Electric Co.

TIMERS, AUTOMATIC, Process
Am. Gas Accumulator
Autocall Co.
Automatic Elec. Mfg.
Automatic Temp. Control
Bristol Co.
Consol. Ashcroft Hancock
Cramer & Co., Inc.
Denver Fire Clay
Eagle Signal Corp.
Electric Controller
Elec. Switch Corp.
Gaertner Scientific Corp.
Industrial Engr. Corp.
Industrial Inst. Co.
Luxtrol Co., Inc.
Magnetic Gauge Co.
Paragon Electric Co.
Powers Regulator Co.
Southw'n Electronics Labs.
Stromberg Electric Co.
Struthers-Dunn
Tagliabue Mfg. Co.
Taylor Inst. Cos.
United Cinephone Corp.
Warren Telechron Co.
West. Electro-Mechanical
Weston Elec. Inst. Corp.
Zenith Electric Co.

TIMERS, AUTOMATIC, Spot Weld
Allen-Bradley Co.
Am. Gas Accumulator
Cramer & Co., Inc.
Cutler-Hammer, Inc.
Electric Controller
General Elec. Co.
United Cinephone Corp.

TOOLMAKER'S FLATS
Fecker, J. W.
Pratt & Whitney
Van Keuren Co.
Zeiss, Inc., Carl

TOPOGRAPHIC INSTRUMENTS (See Surveying Instruments)

TORQUE GAGES (See Gages, Torque)

TORSIOGRAPH
Baldwin-Southwark Corp.
Commercial Engr. Labs.

TORSION METERS
Boulin Inst. Corp.
Cummings Mach. Works
Holz, Herman A.
Kurman Electric Co.
Riehle Div.
Saxl Inst. Co.
Toledo Scale Co.

TOTALIZERS, Demand
American Meter Co.
General Elec. Co.
United Cinephone Corp.
Westinghouse Elec. & Mfg.

TOTALIZERS, Electric Energy
Autocall Co.
Esterline-Angus Co.
General Elec. Co.
Westinghouse Elec. & Mfg.

TOTALIZERS, Fluid Flow
Bailey Meter Co.
Brown Inst. Co.
Builders Iron Foundry
Henszey Co.
Mason-Neilan Regulator
Republic Flow Meters
Tagliabue Mfg. Co.
Taylor Inst. Cos.

TOTALIZERS, Gas Flow
American Meter Co.

TOTALIZERS, Running Time
Cramer & Co., Inc.
Elec. Tachometer Corp.
Photoswitch, Inc.
Production Instrument
Southw'n Electronics Labs.
United Cinephone Corp.
Westinghouse Elec. & Mfg.

TRAFFIC SIGNALING DEVICES (See Signaling Devices, Traffic)

TRAMMELS, Steel Beam
Union Tool Co.

TRANSFORMERS, Adjustable
General Radio Co.

TRANSFORMERS, Experimenter's Variable Voltage
Dongan Electric Mfg.

TRANSFORMERS, Instrument
Allis-Chalmers Mfg.
Annis Co.
Columbia Elec. Mfg.
Dongan Electric Mfg.
Elec. Facilities, Inc.
Esterline-Angus Co.
Friez & Sons
General Elec. Co.
Hickok Elec. Inst. Co.
Industrial Engr. Corp.
Lipman Engg. Co.
Miller Co., Bertrand F.
Roller-Smith Co.
Sangamo Electric Co.
Thordarson Elec. Co.
United Transformer Corp.
West. Electro-Mechanical
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

TRANSFORMERS, Insulation Testing
Dongan Electric Mfg.

TRANSFORMERS, Laboratory
American Transformer
Central Scientific Co.
Clough-Brengle Co.
Daven Co.
Dongan Electric Mfg.
Eastern Specialty Co.
Elec. Facilities, Inc.
General Elec. Co.
General Radio Co.
Halldorson Co.
Standard Elec. Prods.
Miller Co., Bertrand F.
Raytheon Mfg. Co.
Thordarson Elec. Co.
United Transformer Corp.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

TRANSFORMERS, Phasing
Dongan Electric Mfg.
Eastern Specialty Co.
Stater Co.
Thordarson Mfg. Co.
United Transformer Corp.
Westinghouse Elec. & Mfg.

TRANSFORMERS, Power
Ferranti Electric

TRANSFORMERS, Split Core
Elec. Facilities, Inc.
General Elec. Co.
H-D Elec. Co.
Industrial Eng. Corp.
Roller-Smith Co.
Rubicon Co.
Sangamo Electric Co.
Thordarson Elec. Co.
United Transformer Corp.
Western Electro-Mech.
Westinghouse Elec. & Mfg.

TRANSFORMERS, Variable Voltage Testing
American Transformer
Dongan Electric Mfg.

TRANSITS, Astronomical
American Askania Corp.

TRANSITS, Engineer's (See Surveying Instruments)

TRANSITS, Pocket
Ainsworth & Sons
Keuffel & Esser Co.
Mico Instrument Co.
Speidel & Co.
Warren-Knight Co.
White Co., Inc.

TRUCK MILEAGE RECORDERS (See Meters, Mileage)

TRUCK-TIME RECORDERS
Cramer & Co., Inc.
Durant Mfg. Co.
Ohmer Register Co.
Service Recorder Co.

TRUCK, TIME & MILEAGE RECORDERS
Cramer & Co., Inc.
Ohmer Register Co.
Sangamo Electric Co.

TUBES (See also Gas & Vapor Discharge Tubes)

TUBES, Cathode Ray (See Cathode Ray Tubes)

TUBES, Nessler (See Nessler Tubes)

TUBES, Oil Centrifuge (See Oil Centrifuge Tubes)

TUBES, Pitot (See Flowmeters, Pitot Tube)

TUBES, Polariscope
Akatos, Inc.
American Inst. Co.
Bausch & Lomb Optical
Central Scientific Co.
Eimer & Amend
Fecker, J. W.
Gaertner Scientific Corp.
Hellige, Inc.
Precision Scientific Co.
Sargent & Co.

TUBES, Precision Bore (See Precision Bore Glass Tubing)

TUBES, Spectrum (See Spectrum Tubes)

TUBES, Ultra-Violet Light (See Ultra-Violet Light Sources)

TUBES, Vacuum
Arcturus Radio Tube Co.
Central Scientific Co.
General Elec. Co.
General Scientific Corp.
General Television Corp.
Raytheon Mfg. Co.
RCA Manufacturing Co.
Wheelco Inst. Co.

TUBES, Venturi (See Flowmeters, Venturi)

TUBES, X-Ray
American Inst. Co.
Baird Associates
Corning Glass Works
General Electric X-Ray
Kelley-Koett Mfg.
Westinghouse X-Ray Co.

TUNING FORKS, Electrically Driven (See Forks, Tuning)

TURBIDIMETER
Akatos, Inc.
American Inst. Co.
Cargille, R. P.
Central Scientific Co.
Eimer & Amend
Ess Instrument Co.
Fisher Scientific Co.
Hellige, Inc.
Kimble Glass Co.
Klett Mfg. Co.
Luxtrol Co., Inc.
Parr Instrument Co.
Pfaltz & Bauer, Inc.
Photoswitch, Inc.
Precision Scientific Co.
Rawson Electrical Inst.
Rubicon Co.
Sensitive Research Inst.
Southw'n Electronics Labs.
Zeiss, Inc., Carl

TURN & BANK INDICATORS
Kollsman Inst. Co.

TURN INDICATOR TESTERS (See Testers, Turn Indicator)

TWIST COUNTERS (See Counters, Twist)

ULTRA-VIOLET INDICATORS & RECORDERS
Hanovia Chem. & Mfg.

U-TUBE MANOMETERS (See Manometers)

ULTRA-VIOLET LIGHT SOURCES (See Light Sources)

VACUUM, Indicators
Allen Elec. & Equip.
American Meter Co.
Ashton Valve Co.
Bailey Meter Co.
Baird Associates
Bristol Co.
Brown Inst. Co.
Central Scientific Co.
Consol. Ashcroft Hancock
Eimer & Amend
Foxboro Co.
General Elec. Co.
Kollsman Inst. Co.
Mason-Neilan Regulator
Moeller Instrument Co.
Potter Co.
Precision Therm. & Inst.
Rawson Electrical Inst.
Republic Flow Meters
Rochester Mfg. Co.
Scientific Glass Apparatus
Star Brass Mfg. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Uehling Instrument Co.

VACUUM, Recorders
American Meter Co.
Ashton Valve Co.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft Hancock
Dickson Co.
Esterline-Angus Co.
Foxboro Co.
Mason-Neilan Regulator
Republic Flow Meters
Scientific Instrument Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Uehling Instrument Co.

VACUUM GAGES, Hot-Wire
Continental Elec. Co.
Fuess, Inc.
General Elec. Co.

VACUUM GAGES, Ionization
General Elec. Co.
General Television Corp.

VACUUM GAGES, Liquid-column
American Meter Co.
Bacharach Industrial Inst.
Defender Automatic Reg.
Dubrovin, John
Gas Appliance Specialties
Lantz-Phelps Corp.
Meriam Co.
Precision Term. & Inst.
Scientific Glass Apparatus
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Uehling Instrument Co.

VACUUM GAGES, McLeod
Ace Glass, Inc.
Central Scientific Co.
Eimer & Amend
General Elec. Co.
General Physical Lab.
Macalaster Bicknell Co.
Scientific Glass Apparatus
Welch Mfg. Co.

VACUUM GAGE, Pirani Type
Distillation Products

VACUUM, HIGH (below 1 mu) **Controllers**
Area Regulators, Inc.
Bristol Co.
Defender Automatic Reg.
Electronic Prod. Co.
Foxboro Co.
Hoke, Inc.
Tagliabue Mfg. Co.

VACUUM, HIGH (Below 1 mu) **Indicators**
Baird Associates
Bristol Co.
Continental Elec. Co.
Defender Automatic Reg.
Eimer & Amend
Foxboro Co.
General Elec. Co.
General Physical Lab.
Tagliabue Mfg. Co.
Welch Mfg. Co.

VACUUM, HIGH (Below 1 mu) **Recorders**
Bristol Co.
Defender Automatic Reg.
Foxboro Co.
Tagliabue Mfg. Co.

VACUUM SPECTROGRAPHS (See Spectrographs, Vacuum)

VACUUM TUBES (See Tubes, Vacuum)

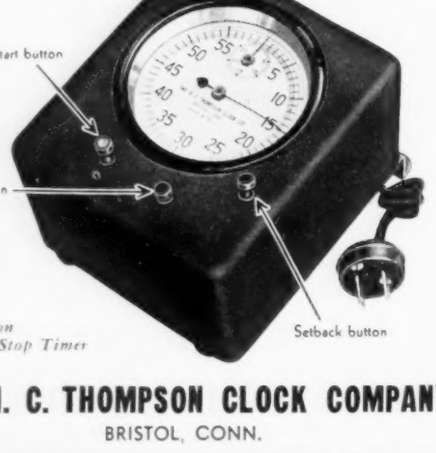
VACUUM TUBE BRIDGES (See Bridges, Vacuum Tube)

VACUUM TUBE RELAYS (See Relays, Vacuum Tube)

KWIXSET Time Controls are furnished for automatically timing operations varying from 10 seconds to 12 hours by operating switches and relays for necessary loads.

Thompson Electric STOP TIMERS supersede stop watches for accurate timing. The 3" dial makes reading to 1/5th second very easy. Rugged instrument suitable for laboratory use or production operations.

Kwixset Time Control



Thompson Electric Stop Timer

THE H. C. THOMPSON CLOCK COMPANY
BRISTOL, CONN.

For addresses, see pages 54-58

VACUUM TUBE VOLTMETERS (See Voltmeters, Vacuum Tube)

VALVE BOX FINDER (See Finder, Valve Box)

VALVE-OPERATING DEVICES, Electric Motor
Baldwin-Southwark Corp.
Barber-Coleman Co.
Beck Co.
Brown Inst. Co.
Cramer & Co., Inc.
Cutler-Hammer, Inc.
Dickson Co.
Foxboro Co.
General Controls Co.
Hays Corp.
Illinois Eng. Co.
Jenkins Bros.
McAlear Mfg. Co.
R-S Products Corp.
Ruggles-Klingemann
Tagliabue Mfg. Co.

VALVE OPERATING DEVICES, Electric Solenoid
Automatic Products Co.
Automatic Switch Co.
Barber-Coleman Co.
Brown Inst. Co.
Cutler-Hammer, Inc.
Electric Valve Mfg.
Electrimatic Corp.
Frick Co.
General Controls Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Hagan Corp.
Hannifin Mfg. Co.
Hays Corp.
Leslie Co.
McDonnell & Miller
Penn Electric Switch
Perfex Corp.
Refrigerating Spec. Co.
R-S Products Corp.
Ruggles-Klingemann
Supreme Elec. Prods.
Spence Engineering Co.
Tagliabue Mfg. Co.

VALVE OPERATING DEVICES, Hydraulic
Area Regulators, Inc.
Askania Regulator Co.
Atlas Valve Co.
Automatic Temp. Control
Bailey Meter Co.
Cash Co.
Controls, Inc.
General Controls Co.
General Elec. Co.
Hagan Corp.
Hanlon-Waters, Inc.
Hannifin Mfg. Co.
Hays Corp.
Hunt & Son
International Filter Co.
Jenkins Bros.
Mason-Neilan Regulator
McAlear Mfg. Co.
Republic Flow Meters
Robertshaw Thermostat
R-S Products Corp.
Ruggles-Klingemann
Schade Valve Mfg.
Spence Engineering Co.

VALVE-OPERATING DEVICES, Pneumatic
Askania Regulator Co.
Atlas Valve Co.
Brown Inst. Co.
Cash Co.
Consol. Ashcroft Hancock
Foxboro Co.
Hagan Corp.
Hanlon-Waters, Inc.
Hannifin Mfg. Co.
Hunt & Son
Illinois Eng. Co.
Industrial Instrument Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Powers Regulator Co.
Republic Flow Meters
R-S Products Corp.
Ruggles-Klingemann
Tagliabue Mfg. Co.
Taylor Inst. Cos.

VALVE POSITION INDICATORS
Autocall Co.
Automatic Temp. Control
Bailey Meter Co.
Beck Co.
Bendix Marine Products
Builders Iron Foundry
Consol. Ashcroft Hancock
Elec. Indicator Corp.
Elec. Tachometer Corp.
General Regulator Corp.
Hanlon-Waters, Inc.
Northern Equip. Co.
Southw'n Electronics Labs
Taylor Inst. Cos.
Tefft-Jackson, Inc.

VALVES, Ammonia & Sulphur Dioxide
Frick Co.
Judson Governor Co.
Cash Co.
Crosby Steam Gage Co.
D'Este Co.
General Controls Co.
Hoke, Inc.

VALVES, Ammonia & Sulphur Dioxide (Cont'd)
Jenkins Bros.
Klingerit, Inc.
Perfex Corp.
Refrigerating Spec. Co.
R-S Products Corp.
Spence Engineering Co.
Taylor Inst. Cos.
Vogt Machine Co.

VALVES, Automatic Shut-off
Automatic Switch Co.
Automatic Valve Control
Belfield Co.
Brown Inst Co.
Davis Reg. Co.
Eclipse Fuel Engg. Co.
Fisher Governor Co.
Foster Engg. Co.
Frick Co.
Friez & Sons
General Controls Co.
General Sales & Prod.
Hagan Corp.
Hanlon-Waters, Inc.
Jerguson Gage Co.
Kiely & Mueller
McDonnell & Miller
Partlow Corp.
Ruggles-Klingemann
Payne Furnace & Supply
R-S Products Corp.
Schade Valve Mfg. Co.
Tagliabue Mfg. Co.
Wilgus Mfg. Co.

VALVES, Automatic Solenoid
Atkins & Co.
Atlas Valve Co.
Automatic Switch Co.
Brown Inst. Co.
Davis Reg. Co.
Detroit Lubricator Co.
Electric Valve Mfg. Co.
Electrimatic Corp.
Friez & Sons
General Controls Co.
General Sales & Prod.
Hagan Corp.
Leslie Co.
McDonnell & Miller
Northern Equip. Co.
Partlow Corp.
Penn Electric Switch Co.
Perfex Corp.
Refrigerating Spec. Co.
R-S Products Corp.
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Engineering Co.
Supreme Elec. Prods.
Tagliabue Mfg. Co.

VALVES, Back Pressure
Acme Regulator Co.
American Meter Co.
Atlas Valve Co.
Bailey Meter Co.
Bastian-Blessing Co.
Belfield Co.
Boylston Co.
Cash Co.
Cochrane Corp.
Connelly Iron Sponge
Crosby Steam Gage Co.
Davis Reg. Co.
Electrimatic Corp.
Fisher Governor Co.
Foster Engg. Co.
Gas Appliance Spec.
Hagan Corp.
Hanlon-Waters, Inc.
Illinois Eng. Co.
Jenkins Bros.
Kenyon Instrument Co.
Kiely & Mueller
Klipfel Mfg. Co.
McAlear Mfg. Co.
Nathan Mfg. Co.
Linde Air Products Co.
Mason-Neilan Regulator
Natural Gas Equipment
Refrigerating Spec. Co.
Reynolds Gas Regulator
Ruggles-Klingemann
Spence Engineering Co.
Stickle Steam Specialties
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Wilgus Manufacturing

VALVES, Balanced
American Meter Co.
Atlas Valve Co.
Bailey Meter Co.
Belfield Co.
Boylston Co.
Bristol Co.
Cash Co.
Cochrane Corp.
Connelly Iron Sponge
Davis Reg. Co.
Defender Automatic Reg.
D'Este Co.
Fisher Governor Co.
Ford Reg. Valve Co.
Foster Engg. Co.
General Controls Co.
Hagan Corp.
Hanlon-Waters, Inc.
Illinois Eng. Co.
Industrial Instrument
Jenkins Bros.
Kiely & Mueller
Klipfel Mfg. Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Natural Gas Equipment
Northern Equip. Co.
Powers Regulator Co.

VALVES, Balanced (Cont'd)
Republic Flow Meters
Reynolds Gas Regulator
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Engineering Co.
Tagliabue Mfg. Co.
Utility Mfg. Co.
Watts Regulator Co.
Wilgus Manufacturing

VALVES, Blow-off
Cochrane Corp.
Connelly Iron Sponge
Consol. Ashcroft Hancock
Cramer & Co., Inc.
Eclipse Fuel Engg. Co.
Frick Co.
Jenkins Bros.
Judson Governor Co.
Nathan Mfg. Co.
Natural Gas Equipment
Ohio Injector Co.
Reynolds Gas Regulator
Tagliabue Mfg. Co.
Victor Equipment Co.
Wilgus Manufacturing
Yarnell-Waring Co.

VALVES, Check Valves
Abercrombie Pump Co.
Bastian-Blessing Co.
Belfield Co.
Cochrane Corp.
Connelly Iron Sponge
Consol. Ashcroft Hancock
Cramer & Co., Inc.
Davis Reg. Co.
Foster Engg. Co.
Frick Co.
Gas Appliance Specialties
Industrial Instrument
Jenkins Bros.
Kenyon Instrument Co.
Nathan Mfg. Co.
Ohio Injector Co.
Preferred Utilities Mfg.
Reynolds Gas Regulator
Ruggles-Klingemann
Star Brass Mfg.
Trill Indicator Co.
Utility Mfg. Co.
Vapor Recovery Systems
Williams Gauge Co.

VALVES, Chlorine
Area Regulators
Everson Mfg. Co.
Hoke, Inc.
Jenkins Bros.
Ohio Injector Co.

VALVES, Compressed Gas
American Meter Co.
Bastian-Blessing Co.
Cash Co.
Connelly Iron Sponge
Fisher Governor Co.
Foster Engg. Co.
Hoke, Inc.
Linde Air Products Co.
Jenkins Bros.
Mason-Neilan Regulator
Parr Instrument Co.
Tagliabue Mfg. Co.

VALVES, Constant Pressure
Bailey Meter Co.
Belfield Co.
Cash Co.
Connelly Iron Sponge
Davis Reg. Co.
D'Este Co.
Dockson Co.
Fisher Governor Co.
Foster Engg. Co.
Hagan Corp.
Hanlon-Waters, Inc.
Hoke, Inc.
Jenkins Bros.
Klipfel Mfg. Co.
Mason-Neilan Regulator
Powers Regulator Co.
Refrigerating Spec. Co.
Reynolds Gas Regulator
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Engineering Co.
Tagliabue Mfg. Co.
Vaughn-G E. Witt Co
Wilgus Manufacturing

VALVES, Diaphragm
Atlas Valve Co.
Bailey Meter Co.
Bastian-Blessing Co.
Belfield Co.
Boylston Co.
Bristol Co.
Brown Inst. Co.
Cash Co.
Connelly Iron Sponge
Consol. Ashcroft Hancock
Davis Reg. Co.
Defender Automatic Reg.
D'Este Co.
Foster Engg. Co.
General Controls Co.
Hagan Corp.
Hanlon-Waters, Inc.
Illinois Eng. Co.
Industrial Instrument
Johnson Service Co.
Kiely & Mueller
Klipfel Mfg. Co.
Leslie Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
McCorkle Co.
National Airoil Burner
Natural Gas Equipment
Partlow Corp.
Payne Furnace & Supply

VALVES, Diaphragm (Cont'd)
Powers Regulator Co.
Refrigerating Spec. Co.
Reynolds Gas Regulator
Ruggles-Klingemann
Schade Valve Mfg. Co.
Scientific Instrument Co.
Spence Engineering Co.
Spencer Thermostat Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Vaughn-G E. Witt
White-Rodgers Electric
Wilgus Manufacturing

VALVES, Differential
Atlas Valve Co.
Bailey Meter Co.
Belfield Co.
Boylston Co.
Brown Inst. Co.
Cash Co.
Connelly Iron Sponge
Davis Reg. Co.
D'Este Co.
Fisher Governor Co.
Foster Engg. Co.
Hagan Corp.
Hanlon-Waters, Inc.
Illinois Eng. Co.
Kiely & Mueller
Klipfel Mfg. Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Natural Gas Equipment
Northern Equip. Co.
Reynolds Gas Regulator
R-S Products Corp.
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Engineering Co.
Tagliabue Mfg. Co.
Wilgus Manufacturing

VALVES, Electrically Operated
Atkins & Co.
Automatic Products Co.
Automatic Switch Co.
Automatic Temp. Control
Atlas Valve Co.
Bristol Co.
Brown Inst. Co.
Cochrane Corp.
Cutler-Hammer, Inc.
Davis Reg. Co.
Defender Automatic Reg.
Detroit Lubricator Co.
Electric Valve Mfg.
Electrimatic Corp.
Foster Engg. Co.
Frick Co.
Friez & Sons
General Controls Co.
Hannifin Mfg. Co.
Hunt & Son
Illinois Eng. Co.
Jenkins Bros.
Kiely & Mueller
Klipfel Mfg. Co.
Leslie Co.
Magnatrol Valve Corp.
Mason-Neilan Regulator
McAlear Mfg. Co.
McCorkle Co.
McDonnell & Miller
Northern Equipment Co.
Payne Furnace & Supply
Penn Electric Switch
Perfex Corp.
Refrigerating Spec. Co.
Ross Operating Valve
Ruggles-Klingemann
Schade Valve Mfg. Co.
Shallcross Mfg. Co.
Spence Engineering Co.
Supreme Elec. Prods.
Tagliabue Mfg. Co.
White-Rodgers Elec. Co.

VALVES, High Pressure
American Inst. Co.
Area Regulators, Inc.
Atlas Valve Co.
Bailey Meter Co.
Bastian-Blessing Co.
Belfield Co.
Boylston Co.
Cash Co.
Cochrane Corp.
Connelly Iron Sponge
Consol. Ashcroft Hancock
Crosby Steam Gage
Davis Reg. Co.
D'Este Co.
Fisher Governor Co.
Foster Engg. Co.
Hagan Corp.
Hanlon-Waters, Inc.
Hoke, Inc.
Hunt & Son
Industrial Instrument Co.
Jenkins Bros.
Kiely & Mueller
Klipfel Mfg. Co.
Linde Air Products Co.
Mason-Neilan Regulator
Merco Nordstrom Valve
Nathan Mfg. Co.
Natural Gas Equipment
Republic Flow Meters
Ruggles-Klingemann
Spence Engineering Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Vogt Machine Co.
Wilgus Manufacturing

VALVES, Indicating Steam Control
Brown Inst. Co.
Cash Co.
Hagan Corp.
(Continued on next page)

Foxboro Valves for air-operated controllers should be specified with Foxboro Controllers — because the characteristic of the Valve should fit the characteristic of the Instrument. The Valve is a vital part of a Control installation. The Foxboro line is engineered to assure the best results.

For complete information write for Bulletin No. 214. The Foxboro Company, 46 Neponset Avenue, Foxboro, Mass., U.S.A. Branch offices in 25 Principal Cities.

OK

HOKE

Gas Pressure Reducing Valves for use with all non-corrosive gases, and also ammonia and hydrogen sulfide.

Flow gages for delivery of compressed gases at a constant measured rate. Flowmeters for laboratory use.

Small needle valves and needle valve controls. Types for pressures up to 15,000 pounds and down to 10^{-6}mm of mercury.

Oxygen-gas torches for working Pyrex and quartz, for soldering, brazing, melting platinum, etc.

Consult us concerning your gas pressure and gas flow problems. It is our aim to be of assistance in overcoming your difficulties.

For catalog, write to

HOKE, Incorporated
124 Fifth Avenue, New York, N. Y.

For addresses, see pages 54-58

VALVES, Indicating Steam Control (Cont'd)
Mason-Neilan Regulator
National Airoil Burner
Powers Regulator Co.
Spence Engineering Co.
Sterling Eng. Co.
Tagliabue Mfg. Co.

VALVES, Lubricated Plug
Merco Nordstrom Valve

VALVES, Motor Operated
Atlas Valve Co.
Automatic Temp. Control
Baldwin-Southwark Corp.
Belfield Co.
Brown Inst. Co.
Cochrane Corp.
Consol. Ashcroft Hancock
Cutler-Hammer, Inc.
Davis Reg. Co.
Defender Automatic Reg.
Fisher Governor Co.
Foster Engg. Co.
Friez & Sons
General Controls Co.
Hagan Corp.
Illinois Eng. Co.
Jenkins Bros.
Kiely & Mueller
Leslie Co.
Mason-Neilan Regulator
Merco Nordstrom Valve
Natural Gas Equipment
Northern Equipment Co.
Preferred Utilities Mfg.
R-S Products Corp.
Ruggles-Klingemann
Spence Engineering Co.
Sterling Eng. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Vogt Machine Co.

VALVES, Needle
American Meter Co.
Ashton Valve Co.
Atlas Valve Co.
Baldwin-Southwark Corp.
Bastian-Blessing Co.
Belfield Co.
Dockson Co.
Fisher Governor Co.
Hoke, Inc.
Jenkins Bros.
Kenyon Instrument Co.
Kiely & Mueller
Mason-Neilan Regulator
Ohio Injector Co.
Reynolds Gas Regulator
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Vogt Machine Co.

VALVES, Pressure Relief
Abercrombie Pump Co.
American Meter Co.
Ashton Valve Co.
Atlas Valve Co.
Bastian-Blessing Co.
Boylston Co.
Cash Co.
Cochrane Corp.
Connelly Iron Sponge
Consol. Ashcroft Hancock
Crosby Steam Gage Co.
Davis Reg. Co.
D'Este Co.
Detroit Lubricator Co.
Fisher Governor Co.
Foster Engg. Co.
Hagan Corp.
Hanlon-Waters, Inc.
Illinois Eng. Co.
Industrial Instrument
Kenyon Instrument Co.
Kiely & Mueller
Klipfel Mfg. Co.
Lammert & Mann Co.
Marsh Corp., Jas. P.
Mason-Neilan Regulator
McAlear Mfg. Co.
Natural Gas Equipment
Powers Regulator Co.
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Engineering Co.
Spencer Thermostat Co.
Star Brass Mfg. Co.
Tagliabue Mfg. Co.
Thrush & Co.
Vapor Recovery Systems
Vaughn-G. E. Witt Co.
Victor Equipment Co.
Watts Regulator Co.
Wilgus Manufacturing

VALVES, Proportional Air Gas
American Meter Co.
Bristol Co.
Brown Inst. Co.
Cash Co.
Connelly Iron Sponge
Eclipse Fuel Engg. Co.
Fisher Governor Co.
Hagan Corp.
Hanlon-Waters, Inc.
Lammert & Mann Co.
Mason-Neilan Regulator
R-S Products Corp.

VALVES, Reducing
Am. Dist. Steam Co.
American Meter Co.
Bailey Meter Co.
Bastian-Blessing Co.
Belfield Co.
Boylston Co.

VALVES, Reducing (Cont'd)
Brown Inst. Co.
Cash Co.
Davis Reg. Co.
D'Este Co.
Dockson Co.
Eclipse Fuel Engg. Co.
Fisher Governor Co.
Ford Reg. Valve Co.
Foster Engg. Co.
Fulton Sylphon Co.
General Sales & Prod.
Hagan Corp.
Hanlon-Waters, Inc.
Hoke, Inc.
Illinois Eng. Co.
Kiely & Mueller
Klipfel Mfg. Co.
Leslie Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Natural Gas Equipment
Northern Equipment Co.
Powers Regulator Co.
Republic Flow Meters
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Engineering Co.
Stickle Steam Specialties
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thrush & Co.
Vaughn-G. E. Witt
Watts Regulator Co.
Wilgus Manufacturing

VALVES, Regulating
Am. Gas Furnace Co.
American Meter Co.
Arca Regulators, Inc.
Atlas Valve Co.
Automatic Valve Control
Bailey Meter Co.
Bastian-Blessing Co.
Belfield Co.
Boylston Co.
Boiler Room Equipment
Bristol Co.
Brown Inst. Co.
Cash Co.
Cochrane Corp.
Connelly Iron Sponge
Consol. Ashcroft Hancock
Davis Reg. Co.
Defender Automatic Reg.
D'Este Co.
Dockson Co.
Electrimatic Corp.
Fisher Governor Co.
Ford Reg. Valve Co.
Foster Engg. Co.
Friez & Sons
Fulton Sylphon Co.
General Controls Co.
Hagan Corp.
Hanlon-Waters, Inc.
Hannifin Mfg. Co.
Illinois Eng. Co.
Jenkins Bros.
Kiely & Mueller
Klipfel Mfg. Co.
Lammert & Mann Co.
Leslie Co.
Linde Air Products Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
National Airoil Burner
Natural Gas Equipment
Northern Equipment Co.
Partlow Corp.
Powers Regulator Co.
Republic Flow Meters
Robertshaw Thermostat
R-S Products Corp.
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Engineering Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thrush & Co.
Trane Co.
Vaughn-G. E. Witt
Victor Equipment Co.
Wilgus Manufacturing

VALVES, Safety Fuel Shut-off
American Meter Co.
Askania Regulator Co.
Atlas Valve Co.
Automatic Products Co.
Automatic Switch Co.
Bristol Co.
Brown Inst. Co.
Cash Co.
Davis Reg. Co.
D'Este Co.
Detroit Lubricator Co.
Eclipse Fuel Engg. Co.
Friez & Sons
Fulton Sylphon Co.
General Combustion Corp.
General Controls Co.
Hagan Corp.
Hanlon-Waters, Inc.
Mason-Neilan Regulator
McAlear Mfg. Co.
McDonnell & Miller
Milwaukee Gas Specialty
National Airoil Burner
Natural Gas Equipment
Partlow Corp.
Payne Furnace & Supply
Penn Electric Switch
Preferred Utilities Mfg.
R-S Products Corp.
Ruggles-Klingemann
Spence Engineering Co.
Spencer Thermostat Co.
Viking Instrument Co.
Wilgus Manufacturing

VALVES, Solenoid
Atkins & Co.
Atlas Valve Co.
Automatic Products Co.
Automatic Switch Co.
Barber-Coleman Co.
Brown Inst. Co.
Cutler-Hammer, Inc.
Davis Reg. Co.
Detroit Lubricator Co.
Electric Valve Mfg. Co.
Electrimatic Corp.
Foxboro Co.
Frick Co.
Friez & Sons
General Controls Co.
General Sales & Prod.
Hagan Corp.
Hann fin Mfg. Co.
Hook & Ackerman
Hunt & Co.
Leslie Co.
Magnatrol Valve Corp.
Penn Electric Switch
Perfex Corp.
Refrigerating Spec. Co.
Ross Operating Valve
R-S Products Corp.
Ruggles-Klingemann
Spence Engineering Co.
Sterling Eng. Co.
Supreme Elec. Prods.
Tagliabue Mfg. Co.

VALVES, Thermostat
Atlas Valve Co.
Automatic Products Co.
Barber-Coleman Co.
Detroit Lubricator Co.
Edison Elec. Controls
Foster Engg. Co.
Friez & Sons
Fulton Sylphon Co.
Hagan Corp.
Illinois Eng. Co.
Klipfel Mfg. Co.
McAlear Mfg. Co.
Partlow Corp.
Powers Regulator Co.
Robertshaw Thermostat
Ruggles-Klingemann
Spence Engineering Co.
Sterling Eng. Co.
Tagliabue Mfg. Co.
Vaughn-G. E. Witt
White-Rodgers Electric

VALVES, Water Motor Operated
Arca Regulators, Inc.
Atlas Valve Co.
Barber-Coleman Co.
Cash Co.
Controls, Inc.
Defender Automatic Reg.
Foster Engg. Co.
Hagan Corp.
Jenkins Bros.
Kiely & Mueller
Leslie Co.
Mason-Neilan Regulator
Powers Regulator Co.
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Engineering Co.
Sterling Eng. Co.

VEHICLE TRAVEL RECORDERS
Commercial Engg. Labs.
Cramer & Co.
Elec. Tachometer Corp.
Ohmer Register Co.
Pittsburgh Taximeter Co.
Service Recorder Co.

VENTURI METERS (See Flowmeters, Venturi)

VENTURI TUBES (See Flowmeters, Venturi)

VIBRATION PICKUPS
Brush Development Co.
Shure Brothers

VIBROGRAPHS
American Askania Corp.
Baldwin-Southwark Corp.
Cambridge Inst. Co.
Central Scientific Co.
Chicago Apparatus Co.
Commercial Engg. Labs.
Impact Register Co.
RCA Manufacturing Co.

VIBROMETERS
American Askania Corp.
American Inst. Co.
Ballantine Labs.
Electrical Research Prod.
Electrocon Corp.
Heiland Research Corp.
Potter Co.
Suter, Alfred

VIBROSCOPES
Annette Corp.
Commercial Engg. Labs.

VICAT NEEDLES (See (See Needles, Vicat)

VISCOSIMETERS, Brookfield
Brookfield Eng. Labs.

VISCOSIMETERS, Engler
American Inst. Co.
Bocked & Co.
Central Scientific Co.
Humboldt Mfg. Co.
Precision Scientific Co.
Ruehfel Co.

VISCOSIMETERS, Fenske
American Inst. Co.

VISCOSIMETERS Ford (For Paint)
Central Scientific Co.
Eimer & Amend
Scientific Inst. Co.

VISCOSIMETERS, Hoepler
Central Scientific Co.
Fish-Schurman Co.

VISCOSIMETERS, Kinematic
Eimer & Amend

VISCOSIMETERS, Mac-Michael
Eimer & Amend

VISCOSIMETERS, Recording
Binckley, G. S.
Esterline-Angus Co.

VISCOSIMETERS, Redwood
American Inst. Co.
Ruehfel Co.

VISCOSIMETERS, Saybolt
American Inst. Co.
Bocked & Co.
Central Scientific Co.
Corning Glass Works
Humboldt Mfg. Co.
Kimble Glass Co.
Precision Scientific Co.
Ruehfel Co.
Tagliabue Mfg. Co.
Zuhr, Inc., Henry

VISCOSIMETERS, Scott
Bocked & Co.
Central Scientific Co.
Precision Scientific Co.
Ruehfel Co.

VISCOSIMETERS, Standard Oil
American Inst. Co.
Central Scientific Co.
Ruehfel Co.

VISCOSIMETERS, Stormer
Central Scientific Co.
Industro-Scientific Co.
Thomas Co., Arthur H.

VISCOSIMETERS, Ubbelohde
American Inst. Co.
Central Scientific Co.
Fish-Schurman Co.

VISCOSIMETERS, Zahn
General Elec. Co.

VISCOSITY REGULATORS (See Controllers, Automatic, Viscosity)

VISCOSITY TUBES
Cargille, R. P.

VOLT-AMMETERS
Allen Elec. & Equip.
Am. Elec. Sales Co.
Clough-Brengle Co.
De Jur-Amsco Corp.
General Elec. Co.
Hickok Elec. Inst. Co.
RCA Manufacturing Co.
Reliance Instrument Co.
Supreme Instruments
Triplett Electrical Inst.
Welch Mfg. Co.

VOLTAGE ADJUSTERS, AUTOMATIC
General Elec. Co.
Ideal Commutator Dresser
Roller-Smith Co.
United Transformer Corp.

VOLTAGE DETECTORS (See Detectors, Voltage)

VOLTAGE DIVIDERS, Radio Frequency (See Dividers, Voltage)

VOLTAGE, HIGH (above 2300 volts) **Indicators**
General Elec. Co.
General Physical Lab.
Ideal Commutator Dresser
Rawson Electrical Inst.
Roller-Smith Co.
Sensitive Research Inst.
Shallcross Mfg. Co.
Triplett Electrical Inst.
Weston Elec. Inst. Corp.

VOLTAGE, HIGH (above 2300 volts) **Measuring Devices**
Associated Research
General Elec. Co.
International Resistance
Roller-Smith Co.
Sensitive Research Inst.
Westinghouse Elec & Mfg.
Westinghouse X-Ray Co.
Weston Elec. Inst. Corp.

VOLTAGE, HIGH (above 2300 volts) **Testing Devices**
American Transformer
Associated Research
General Elec. Co.
Ideal Commutator Dresser
International Resistance
Miller Co., Bertrand F.
Ray'heon Mfg. Co.
Roller-Smith Co.
States Co.
United Transformer Corp.
Weston Elec. Inst. Corp.

VOLTAGE REGULATORS (See Regulators, Automatic, Voltage)

VOLT-AMMETERS
Esterline-Angus Co.
Rawson Electrical Inst.
Roller-Smith Co.
Sensitive Research Inst.
Westinghouse Elec & Mfg.
Weston Elec. Inst. Corp.

VOLTMETERS, Electrostatic
Cambridge Inst. Co.
Ferranti Electric, Inc.
General Elec. Co.
Rawson Electrical Inst.

VOLTMETERS, Indicating
Ballantine Labs.
Bernard, H. J.
Burton-Rogers Co.
Clough-Brengle Co.
Columbia Elec. Mfg.
De Jur-Amsco Corp.
General Elec. Co.
Hickok Elec. Inst. Co.
Niagara Electrical Inst.
Norton Electrical Inst.
Precision Apparatus Corp.
Radio City Products Co.
Rawson Electrical Inst.
RCA Manufacturing Co.
Roller-Smith Co.
Sensitive Research Inst.
Simpson Elec. Co.
Triumph Mfg. Co.
Welch Mfg. Co.
Westinghouse Elec & Mfg.
Weston Elec. Inst. Corp.

VOLTMETERS, Megohm
Associated Research
Bernard, H. J.
Jackson Electrical Inst.
Rawson Electrical Inst.
RCA Manufacturing Co.
Sensitive Research Inst.
Shallcross Mfg. Co.
Sticht & Co.
Welch Mfg. Co.
Weston Elec. Inst. Corp.

VOLTMETERS, Micro
Bernard, H. J.
Cambridge Inst. Co.
De Jur-Amsco Corp.
Hickok Elec. Inst. Co.
Rawson Electrical Inst.
Sensitive Research Inst.
Supreme Instruments
Triplett Electrical Inst.
Weston Elec. Inst. Corp.
Wheelco Inst. Co.

VOLTMETERS, Micro, Radio Frequency
Ferris Inst. Corp.

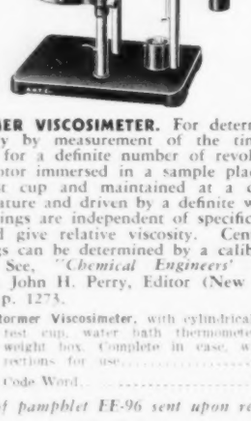
VOLTMETERS, Millivoltmeters
Allen Elec. & Equip.
Ballantine Labs.
Bristol Co.
Burton-Rogers Co.
Cambridge Inst. Co.
De Jur-Amsco Corp.
Engelhard, Chas.
Esterline-Angus Co.
Etna Elec. Works
General Elec. Co.
Hickok Elec. Inst. Co.
Radio City Products Co.
Rawson Electrical Inst.
Roller-Smith Co.
Sensitive Research Inst.
Simpson Elec. Co.
Southw'n Electronics Labs
Tagliabue Mfg. Co.
Thwing-Albert Inst. Co.
Triplett Electrical Inst.
Welch Mfg. Co.
Westinghouse Elec & Mfg.
Weston Elec. Inst. Corp.
Wheelco Inst. Co.

VOLTMETERS, Oxide Rectifier
Bernard, H. J.
Clough-Brengle Co.
De Jur-Amsco Corp.
General Elec. Co.
General Radio Co.
Hickok Elec. Inst. Co.
Radio City Products Co.
Roller-Smith Co.
Simpson Elec. Co.
Supreme Instruments
Triplett Electrical Inst.
Triumph Mfg. Co.
Westinghouse Elec & Mfg.
Weston Elec. Inst. Corp.

VOLTMETERS, Peak
Clough-Brengle Co.
General Elec. Co.
Hickok Elec. Inst. Co.
RCA Manufacturing Co.
Sensitive Research Inst.

VOLTMETERS, Recording
Bristol Co.
Cambridge Inst. Co.
Engelhard, Chas.
Esterline-Angus Co.
General Elec. Co.
Leeds & Northrup Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg.

STORMER VISCOSIMETER



STORMER VISCOSIMETER. For determining viscosity by measurement of the time required for a definite number of revolutions of a rotor immersed in a sample placed in the test cup and maintained at a desired temperature and driven by a definite weight.

Readings can be independent of specific gravity and give relative viscosity. Centipoise readings can be determined by a calibration table. See, *"Chemical Engineers' Handbook"*, John H. Perry, Editor (New York, 1934), p. 1273.

7649. **Stormer Viscosimeter**, with cylindrical rotor, test cup, water bath thermometer, and weight box. Complete in case, with directions for use.....$110.00

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For addresses, see pages 54-58

VOLTMETERS, Thermionic Rectifier
Andrew, Victor J.
Cambridge Inst. Co.
General Radio Co.

VOLTMETERS, Thermo
Am. Elec. Sales Co.
Cambridge Inst. Co.
De Jur-Amsco Corp.
Etna Elec. Works
General Elec. Co.
Hickok Elec. Inst. Co.
Rawson Electrical Inst.
Sensitive Research Inst.
Triplett Electrical Inst.
Weston Elec. Inst. Corp.
Wheelco Inst. Co.

VOLTMETERS, Vacuum Tube
Andrew, Victor J.
Ballantine Labs.
Cambridge Inst. Co.
Clough-Brengle Co.
Fisher Scientific Co.
General Elec. Co.
General Radio Co.
Luxtrol Co., Inc.
Radio City Products Co.
Reliance Instrument Co.
Southw'n Electronics Labs.
Triplett Electrical Inst.
Triumph Mfg. Co.
Weston Elec. Inst. Corp.
Shallcross Mfg. Co.

VOLT-OHMMETERS
Bernard, H. J.
Clough-Brengle Co.
De Jur-Amsco Corp.
Hickok Elec. Inst. Co.
Jackson Electrical Inst.
Precision Apparatus Corp.
Radio City Products Co.
Rawson Electrical Inst.
RCA Manufacturing Co.
Roller-Smith Co.
Sensitive Research Inst.
Shallcross Mfg. Co.
Simpson Elec. Co.
Triplett Electrical Inst.
Triumph Mfg. Co.
Welch Mfg. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

VOLUME CONTROLS
Arca Regulators
Clarostat Mfg. Co.
General Radio Co.
International Resistance

VOLUME INDICATORS
American Meter Co.
Brown Inst. Co.
Daven Co.
General Radio Co.

WATCHES, Chronometer
Bliss & Co.
Burke, Louis
Clebar Watch Co.
Jaeger Watch Co.
Jardur Import Co.
Negus, T. S. & J. D.
Pastor Stop Watch
Stillman Co.

WATCHES, Stop
Aristo Import Co.
Burke, Louis
Central Scientific Co.
Clebar Watch Co.
Ducommun Co.
Elec. Facilities, Inc.
Fish-Schurman Co.
Fisher Scientific Co.
Gaertner Scientific Corp.
Jaeger Watch Co.
Jardur Import Co.
Meylan, A. R. & J. E.
Negus, T. S. & J. D.
Pastor Stop Watch Co.
Pierce Watch Co.
Racine & Co., Jules
Scherr Co., Inc.
Sneidel & Co.
Stillman Co.
Tagliabue Mfg. Co.
Testrite Instrument Co.
Zernickow Co., O.

WATCHES, Stop-Electric
Central Scientific Co.
Elgin Natl. Watch Co.
Jaeger Watch Co.
Meylan, A. R. & J. E.
Stillman Co., M. J.
Thompson Clock Co.,

WATER ANALYSIS OUTFITS
Taylor & Co., Inc.

WATER BATHS, Constant Temperature
Elec. Heat Control App.

WATER FEEDERS, AUTOMATIC
Bailey Meter Co.
Henszey Co.
Mason-Neilan Regulator
McDowell & Miller
Merrit Eng. & Sales Co.
Northern Equip. Co.
Thrush & Co.

WATER METERS (See Liquid Meters)

WATER METER TESTERS (See Testers, Water Meter)

WATER & SEDIMENT APPARATUS
Central Scientific Co.
Davis Reg. Co.,
Precision Scientific Co.
Thomas Co., Arthur H.

WATTHOUR METERS
General Elec. Co.
Westinghouse Elec. & Mfg.

WATTMETERS, Electrostatic
Sensitive Research Inst.

WATTHOUR METER TESTERS (See Testers, Watthour Meter)

WATTMETER, Indicators
Autocall Co.
General Elec. Co.
Hickok Elec. Inst. Co.
Norton Electrical Inst.
Rawson Electrical Inst.
Reliance Instrument Co.
Roller-Smith Co.
Sensitive Research Inst.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

WATTMETER, Recorders
Bristol Co.
Esterline-Angus Co.
General Elec. Co.
Roller-Smith Co.
Sensitive Research Inst.
Westinghouse Elec. & Mfg.

WAVE METERS
Andrew, Victor J.

WAX MELTING APPARATUS
Central Scientific Co.
Fisher Scientific Co.
Precision Scientific Co.

WEATHEROMETER
Atlas Elec. Devices Co.

WEIGHT INDICATORS, Automatic Recording
Atlas Car & Mfg. Co.
Exact Weight Scale Co.
Howe Scale Co.
Martin Decker Corp.
Roller-Smith Co.
Streeter-Amet Co.
Toledo Scale Co.

WEIGHING MACHINES
Automatic Scale Co.
Exact Weight Scale Co.
Gump Co.
International Bus. Mach.
Jacobs Bros. Co., Inc.
Jeffrey Mfg. Co.
Merrick Scale Mfg. Co.
Omega Machine Co.
Richardson Scale Co.
Streeter-Amet Co.
Toledo Scale Co.

WEIGHTS, Analytical
Ainsworth & Sons
Becker, Inc., Christian
Central Scientific Co.
Exact Weight Scale Co.
Fisher Scientific Co.
Gurley, W. & L. E.
Howe Scale Co.
Newark Scale Works
Pfaltz & Bauer, Inc.
Seederer-Kohlbusch, Inc.
Suter, Alfred
Thomas Co., Arthur H.
Torsion Balance Co.
Troemner, Henry
Voland & Sons, Inc.
Welch Mfg. Co.

WEIGHTS, Avoirdupois
Becker, Inc., Christian
Central Scientific Co.
Exact Weight Scale Co.
Gurley, W. & L. E.
Howe Scale Co.
Newark Scale Works
Seederer-Kohlbusch, Inc.
Suter, Alfred
Torsion Balance Co.
Troemner, Henry
Voland & Sons, Inc.

WEIGHTS, Metric
Ainsworth & Sons
Becker, Inc., Christian
eCntral Scientific Co.
Chicago Apparatus Co.
Exact Weight Scale Co.
Gaertner Scientific Corp.
Gurley, W. & L. E.
Keller Mfg. Co.
Newark Scale Works
Seederer-Kohlbusch, Inc.
Sufer, Alfred
Toledo Scale Co.
Torsion Balance Co.
Troemner, Henry
Voland & Sons, Inc.
Welch Mfg. Co.

WEIGHTS, Precision Analytical
Ainsworth & Co.
Becker, Inc., Christian
Central Scientific Co.
Exact Weight Scale Co.
Gurley, W. & L. E.
Microchemical Service
Newark Scale Works
Seederer-Kohlbusch, Inc.
Suter, Alfred
Torsion Balance Co.
Troemner, Henry
Voland & Sons, Inc.

WEIGHTS, Test
Ainsworth & Sons
Becker, Inc., Christian
Central Scientific Co.
Exact Weight Scale Co.
Gaertner Scientific Corp.
Gurley, W. & L. E.
Howe Scale Co.
Newark Scale Works
Seederer-Kohlbusch, Inc.
Toledo Scale Co.
Torsion Balance Co.
Troemner, Henry

WEIGHTS, Troy
Becker, Inc., Christian
Central Scientific Co.
Exact Weight Scale Co.
Gurley, W. & L. E.
Howe Scale Co.
Newark Scale Works
Seederer-Kohlbusch, Inc.
Torsion Balance Co.
Troemner, Henry

WEIGHTS & MEASURES, PRECISION STANDARDS
Becker, Inc., Christian
Gurley, W. & L. E.
Jacobs Bros. Co.
Pfaltz & Bauer, Inc.
Seederer-Kohlbusch, Inc.
Torsion Balance Co.
Troemner, Henry

WEIR METERS (See Flowmeters, Weir)

WIND DIRECTION & VELOCITY INDICATORS
Binckley, G. S.
Electric Speed Ind. Co.
Elec. Tachometer Corp.
Friez & Sons
General Elec. Co.
Geophysical Inst. Co.
Green, Henry J.
Kenyon Instrument Co.
Southw'n Electronics Labs.

WIND DIRECTION & VELOCITY RECORDERS
Binckley, G. S.
Elec. Tachometer Corp.
Esterline-Angus Co.
Friez & Sons
Geophysical Instrument
Green, Henry J.
Kenyon Instrument Co.
Leeds & Northrup Co.
Southw'n Electronics Labs.
Zeiss, Inc., Carl

WIND GAGES (See Gages, Wind)

WIRES, Gear Measuring
Van Keuren Co.

WIRES, Thread Measuring
Sheffield Gage
Van Keuren Co.

X-RAY CAMERAS, Diffraction
Baird Associates
Hayes Scientific App.

X-RAY EQUIPMENT
Fish-Schurman Co.
Gen. Elec. X-Ray Corp.
Hayes Scientific App.
Kelley-Koett Mfg. Co.
Patterson Screen Co.
Westinghouse X-Ray Co.

X-RAY FLUOROSCOPIC SCREENS (See Screens, X-Ray Fluoroscopic)

X-RAY INTENSIFYING SCREENS (See Screens, X-Ray Intensifying)

X-RAY SPECTOGRAPHS (See Spectographs, X-Ray)

X-RAY SPECTROMETERS (See Spectrometers, X-Ray)

X-RAY STEREOSCOPE (See Stereoscope, X-Ray)

X-RAY TUBES (See Tubes, X-Ray)

X-RAY VOLTMETERS, High Potential.
Shallcross Mfg. Co.

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MOTOR CONTROL VALVES AND WIZARD PILOT REGULATORS

FISHER Control Valves with their characterized inner valves produce a fine throttling flow over the first increment of lift and throttle in proper ratio to the travel until maximum capacity is reached. Ask FISHER to specify correctly sized Motor Control Valves — the most important part of any control problem requiring instrument or pilot actuation.

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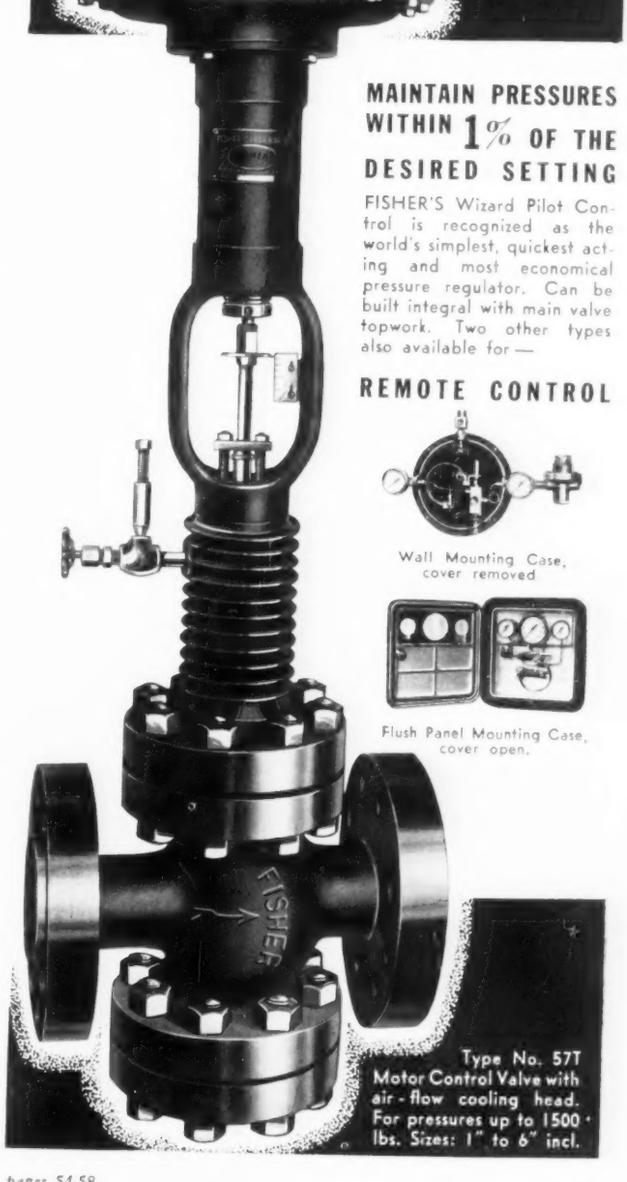

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I

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Industrial Scientific Supply Co., 8201½ Monroe St., Fort Worth, Texas
Industro-Scientific Co., 340 South Camac St., Philadelphia, Pa.
Intercontinental Marketing Corp., 10 E. 40 St., New York, N. Y.
International Business Machines Corp., 590 Madison Ave., New York City, N. Y.
International Equipment Co., 352 Western Ave., Brighton, Boston, Mass.
International Filter Co., 59 East Van Buren St., Chicago, Illinois
International Register Co., 25 South Throop St., Chicago, Illinois
International Resistance Co., 401 North Broad St., Philadelphia, Pa.

J

Jackson Electrical Instrument Co., 129 Wayne Ave., Dayton, Ohio
Jacobs Bros. Co., Inc., 26 Washington St., Brooklyn, N. Y.
Jaeger Watch Co., 304 East 45th St., New York, N. Y.
Jardur Import Co., 21 West 19th St., New York, N. Y.
Jeffrey Mfg. Co., Columbus, Ohio
Jenkins Bros., 80 White St., New York, N. Y.
Jensen Instrument Co., 624 E. 4th St., Los Angeles, Calif.
Jerguson Gage & Valve Co., Mystic Ave. & Fellsway, Somerville, Mass.
Johnson Service Co., 507 E. Michigan St., Milwaukee, Wisconsin
Johnston & Jennings Co., 877 Addison Road, Cleveland, Ohio
Johnston Mfg. Co., 2823 East Hennepin Ave., Minneapolis, Minn.
Jones & Lamson Machine Co., Clinton & Whitmore St., Springfield, Vt.
Jones Motrola Sales Co., 132 Fairfield Ave., Stamford, Conn.
Judson Governor Co., 38 Browns Race, Rochester, New York

K

Kansas City Laboratory Supply Co., 1431 Wyandotte Street, Kansas City, Missouri
Karp Metal Products Co., Inc., 129-30th St., Brooklyn, New York
Kauffmann-Lattimer Co., 263 N. Front St., Columbus, Ohio
Keller Mfg. Co., G. P., 1388 S. State St., Salt Lake City, Utah
Kelley-Koett Mfg. Co., Inc., Covington, Ky.
Kellogg Switchboard & Supply Co., Clearing Station, Chicago, Illinois
Kenyon Instrument Co., Inc., 273 New York Ave., Huntington, Long Island, N. Y.
Kern Co., 136 Liberty St., New York, N. Y.
Kessling Thermometer Co., E., 682-684 Jamaica Ave., Brooklyn, N. Y.
Kettel & Esser Co., 300 Adams St., Hoboken, N. J.
Kewaunee Mfg. Co., 106 Lincoln St., Kewaunee, Wisc.
Kiely & Mueller, 34 W. 13th St., New York, N. Y.
Kimball Co., W. W., 420 Kimball Bldg., Chicago, Ill.
Kimble Glass Co., Vineland, N. J.
King-Seeley Corp., 302 Second St., Ann Arbor, Mich.
Kingsbury Machine Works, Inc., 1316 Tackawanna St., Philadelphia, Pa.
Klett Mfg. Co., 179 E. 87th St., New York, N. Y.
Klingerit, Inc., 16 Hudson St., New York, N. Y.
Klipfel Mfg. Co., 2651 W. Harrison St., Chicago, Ill.
Knowles Scale Works, 78 Fletcher St., Lowell, Mass.
Koch & Co., F. A., 72-78 Spring St., New York, N. Y.
Kolesch & Company, 138 Fulton St., New York, N. Y.
Kollmorgen Optical Co., 767 Wythe Ave., Brooklyn, N. Y.
Kollsman Instrument Co., Inc., 80-05 45th Ave., Elmhurst, Long Island, N. Y.
Kron Co., Bridgeport, Conn.
Krouse Fatigue Machine Co., 101 East Dominion, Columbus, Ohio
Kurman Electric Co., 241 Lafayette St., New York, N. Y.

L

L. A. B. Corporation, P. O. Box 162, Summit, New Jersey
Laboratory Construction Co., 1113-1115 Holmes Street, Kansas City, Missouri
Laboratory Furniture Co., Inc., 37-18 Northern Blvd., Long Island City, N. Y.
Laboratory Materials Co., 7319 Vincennes Ave., Chicago, Illinois
Lambert Meter Co., Inc., Bush Terminal, Building No. 4, Brooklyn, New York
Lammert & Mann Co., 260 North Woods St., Chicago, Illinois
LaMotte Chemical Products Co., McCormick Building, Baltimore, Maryland
Lampkin Laboratories, Bradenton, Florida
Landis & Gyr, Inc., 104 Fifth Ave., New York, N. Y.
Lantz-Phelps Corp., 420 Linden Ave., Dayton, Ohio
LaPine & Co., Arthur S., 114 W. Hubbard St., Chicago, Ill.
Leach Relay Co., 5915 Avalon Blvd., Los Angeles, California
Leeds & Northrup Co., 4984 Stenton Ave., Philadelphia, Pa.
Leitz, Inc., E., 730 Fifth Ave., New York, N. Y.
Leonard Electric Mfg. Co., 3905 Perkins Ave., Cleveland, Ohio
Leslie Co., Lyndhurst, N. J.
Leupold, Volpel & Co., 425 N. E. 70th Ave., Portland, Ore.
Levitt Ferguson Co., 1828 Greenmount Ave., Baltimore, Md.
Lewis Engineering Co., 52 Rubber Ave., Naugatuck, Conn.
Lincoln Meter Co., Inc., Springfield, Ill.
Lincoln Optics, 53 W. Jackson Blvd., Chicago, Ill.
Lindberg Engineering Co., 221 Union Park Court, Chicago, Ill.
Linde Air Products Co., 30 East 42nd St., New York, N. Y.
Link Engineering & Mfg. Co., 1054 West Baltimore Ave., Detroit, Michigan
Lipman Engineering Co., 115 Van Braam St., Pittsburgh, Pa.
Liquidometer Co., Inc., 36-16 Skillman Ave., Long Island City, N. Y.
Littelfuse Labs., 4238 Lincoln Ave., Chicago, Ill.
Loewenberg, F., 10 East 40 St., New York, N. Y.
Lord Manufacturing Co., 1316 Holland Ave., Erie, Pennsylvania
Luers, J. Milton, 3211 Bellevue Ave., Detroit, Mich.
Lumenite Elec. Co., Old Colony Bldg., Chicago, Ill.
Lundquist Tool & Mfg. Co., 57 Jackson St., Worcester, Mass.
Lux Clock Mfg. Co., Inc., 95 Johnson St., Waterbury, Conn.
Luxtrol Co., Inc., 54 West 21st St., New York, N. Y.

M

Macalaster Bicknell Co., 171 Washington St., Cambridge, Mass.
Macbeth Daylighting Co., Inc., 227 W. 17th St., New York, N. Y.
Machlett & Son, E., 220 E. 23rd St., New York, N. Y.
Magnaflux Corp., 605 W. Wash. St., Chicago, Ill.
Magnatrol Valve Corp., 56 Beekman St., New York, N. Y.
Magnavox Co., Inc., Fort Wayne, Indiana
Magnetic Analysis Corp., 12-40 Twelfth St., Long Island City, N. Y.
Magnetic Gauge Co., 60 E. Barnes St., Akron, Ohio
Magnus, Mabee & Reynard, Inc., 16 Desbrosses St., New York, N. Y.
Mahady Co., E. P., 857 Boylston St., Boston, Mass.
Marine-Compass Co., Bryantville, Mass.
Maris Co., John M., 528 Arch St., Philadelphia, Pa.
Marsh Corp., Jas. P., 2063 Southport Ave., Chicago, Illinois
Marston Co., C. A., 506 Washington St., Braintree, Mass.
Martin Decker Corp., P. O. Box 571, Long Beach, Calif.
Martindale Electric Co., Box 2669, Lakewood Branch, Cleveland, Ohio
Mason-Neilan Regulator Co., 1190 Adams St., Boston, Mass.
Master Optical Co., 19 West 36th St., New York, N. Y.
McAlear Mfg. Co., 1901-09 South Western Ave., Chicago, Illinois
McCord Radiator & Mfg. Co., 2587 E. Grand Ave., Detroit, Mich.
McCorkle Co., D. H., Sixth & Bancroft Way, Berkeley, Calif.
McDonnell & Miller, Wrigley Bldg., Chicago, Ill.
McDonnell Odometer Co., 3501 S. Kedzie Ave., Chicago, Ill.
McFarlin Co., 29 W. Marion Ave., Youngstown, Ohio
McKesson-Duster-Northington Co., 1706 First Ave., Birmingham, Ala.
McNeill Engr. Equip. Co., T. W., 4057 West Van Buren St., Chicago, Ill.
Measured Time, Inc., La Porte, Ind.
Meldrum-Gabrielson Corp., 601 W. Fayette St., Syracuse, N. Y.
Merco Nordstrom Valve Co., 400 Lexington Ave., Pittsburgh, Pa.
Mercoid Corp., 4201 Belmont St., Chicago, Ill.
Mercon Regulator Co., 2357 N. 29th St., Milwaukee, Wis.
Meriam Co., 1955 W. 112th St., Cleveland, Ohio
Merrick Scale Mfg. Co., Autumn St., Passaic, N. J.
Merritt Engr. & Sales Co., Inc., 120 So. Niagara St., Lockport, N. Y.
Meter Devices Co., 1001 Prospect Ave., S. W., Canton, Ohio
Meyer, Max, 76-78 Willoughby St., Brooklyn, N. Y.
Meylan, A. R. & J. E., 264 West 40th St., New York, N. Y.
Mico Instrument Co., 10 Arrow St., Cambridge, Mass.
Microchemical Service, 30 Van Zandt Ave., Douglaston, N. Y.
Micro Switch Corp., Spring St., Freeport, Ill.
Middlebury Electric Clock Corp., 1611 N. Lincoln St., Chicago, Ill.
Miller Co., Bertrand F., P. O. Box 455, Trenton, New Jersey
Millers Falls Co., Greenfield, Mass.
Milwaukee Gas Specialty Co., 2025 West Clybourn, Milwaukee, Wisconsin
Mine Safety Appliances Co., Braddock Ave. & Thomas Blvd., Pittsburgh, Penna.
Mine & Smelter Supply Co., 1422-17th St., Denver, Colo.
Minerallac Electric Co., 25 N. Peoria St., Chicago, Ill.
Minneapolis Electric & Construction Co., 80 S. 12th St., Minneapolis, Minn.
Misener Mfg. Co., Inc., 300 E. Washington St., Syracuse, New York
Moeller Instrument Co., 132nd St. & 89th Ave., Richmond Hill, N. Y.
Moist-O-Meter, Inc., Board of Trade Bldg., Kansas City, Missouri
Moline Furniture Works, Moline, Ill.
Monitor Controller Co., Gay, Lombard & Frederick Sts., Baltimore, Md.
Morehouse Machine Co., York, Pa.
Morey & Jones, Ltd., 922 So. Hemlock St., Los Angeles, Calif.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Munsell Color Co., Inc., 10 E. Franklin St., Baltimore, Md.
Muter Co., 1255 S. Michigan Ave., Chicago, Ill.

N

Nashville Surgical Supply Co., 401 Church St., Nashville, Tenn.
Nathan Mfg. Co., 250 Park Ave., New York, N. Y.
National Airoil Burner Co., 1327 Girard Ave., Philadelphia, Penna.
National Aluminate Corp., 6216 W. 66 St., Chicago, Illinois
National Brass Co., Grand Rapids, Mich.
National Electric Controller Corp., 5309 Ravenswood Ave., Chicago, Illinois
National Instrument Co., 44 School St., Boston, Mass.
National Meter Co., 1207 First Ave., Brooklyn, N. Y.
National Scientific Corp., 2111 W. North Ave., Chicago, Illinois
National Technical Labs., 3330 East Colorado St., Pasadena, Calif.
Natural Gas Equipment, Inc., 541 Petroleum Securities Bldg., Los Angeles, Calif.
Negus, T. S. & J. D., 69 Pearl St., New York, N. Y.
Neptune Meter Company, 50 West 50th St., New York, N. Y.
Newark Scale Works, 10-12 Hobson St., Newark, N. J.
N. J. Laboratory Supply Co., 235 Plane St., Newark, N. J.
New Jersey Meter Co., Plainfield, N. J.
N. Y. Laboratory Supply Co., Inc., 530 Broadway, New York, N. Y.
New York Scientific Supply Co., 111 East 22nd St., New York, N. Y.
Niagara Electrical Instrument Co., 1 West Genesee St., Buffalo, N. Y.
Nicholson Meter & Mfg. Co., 115 E. 18th St., Erie, Pa.
Niehoff & Co., C. E., 230 W. Superior St., Chicago, Ill.
Northern Equip. Co., 1945 Grove Drive, Erie, Pa.
North Side Tool Company, Dayton, Ohio
Norton Electrical Instrument Co., 101 Hilliard St., Manchester, Conn.
Nurnberg Thermometer Co., Inc., 397 Bridge St., Brooklyn, N. Y.
Nye, Inc., William F., New Bedford, Mass.

O

Ohio Injector Co., 3 Main St., Wadsworth, Ohio
Ohmer Register Co., Dayton, Ohio
Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago, Ill.
Olsen Testing Machine Co., Tinius, 500 North 12th St., Philadelphia, Pa.
Omega Machine Co., Inc., 1010 Penn Ave., Kansas City, Mo.
Orton Jr. Ceramic Foundation, Edward, 1445 Summit St., Columbus, Ohio

P

Pacific Biological Laboratories, Pacific Grove, Calif.
Palmer Company, 2511 Norwood Ave., Cincinnati, Norwood, Ohio
Palo-Myers, Inc., 81 Reade St., New York, N. Y.
Paragon Electric Co., 37 West Van Buren St., Chicago, Ill.
Parks-Cramer Co., Fitchburg, Mass.
Parr Instrument Co., 222-52 St., Moline, Ill.
Partow Corp., 2 Campion Rd., New Hartford, N. Y.
Pastor Stop Watch Co., 43 East Main St., Waterbury, Conn.
Patterson Screen Co., Towanda, Pa.
Paulson & Co., Henry, 37 S. Wabash Ave., Chicago, Illinois
Paulstick & Sons, H., 2124 Fulton St., Brooklyn, N. Y.
Payne Furnace & Supply Co., Beverly Hills, Calif.
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Penn Electric Switch Co., Box 556, Goshen, Ind.
Pertex Corporation, 415 W. Oklahoma Place, Milwaukee, Wis.
Perkin, Elmer & Moffitt, 90 Broad St., New York, N. Y.
Perkins & Son, Inc., B. F., Holyoke, Mass.
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Philadelphia Thermometer Co., 915 Filbert St., Philadelphia, Pa.
Phipps & Bird, Inc., 140 Virginia St., Richmond, Va.
Photobell Corp., 96 Warren St., New York, N. Y.
Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass.
Pierce Watch Co., 22 West 48th St., New York, N. Y.
Pioneer Instrument Co., 754 Lexington Ave., Brooklyn, N. Y.
Pitometer Log Corp., 206 Lafayette St., New York, N. Y.
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Pittsburgh Instrument & Machine Co., 1026 Reedsdale St., N. S., Pittsburgh, Pa.
Pittsburgh Taximeter Co., Point Bldg., Pittsburgh, Pa.
Pneumatic Scale Corp., Ltd., 74 Newport Ave., Quincy, Mass.
Pneumercator Co., Inc., 305 E. 46th St., New York, N. Y.
Polarized Products Corp., 153-16 10th Ave., Whitestone, N. Y.
Polarizing Instrument Co., 630 Fifth Ave., New York, New York
Post Co., Frederick, 3635 North Hamlin Ave., Chicago, Illinois
Potter Co., 1950 Sheridan Road, North Chicago, Ill.
Powers Regulator Co., 2736 Greenview Ave., Chicago, Illinois
Practical Instrument Co., 2717 North Ashland Ave., Chicago, Illinois
Pratt & Whitney, Division-Niles-Bement-Pond Co., Hartford, Conn.
Precise Instrument Co., 200 Tillary St., Brooklyn, New York
Precision Apparatus Corp., 821 East New York Ave., Brooklyn, New York
Precision Gage & Tool Co., 320 East 3rd St., Dayton, Ohio
Precision Resistor Co., 334 Badger Ave., Newark, N. J.
Precision Scientific Co., 1750 North Springfield Ave., Chicago, Ill.
Precision Thermometer & Instrument Co., 1434 Brandywine St., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., 31 West 60th St., New York, N. Y.
Premier Crystal Laboratories, Inc., 717 Pulitzer Bldg., New York, N. Y.
Production Instrument Co., 710 West Jackson, Chicago, Illinois
Pyro-Electro Instrument Co., 7323-5 W. Chicago Blvd., Detroit, Mich.
Pyrometer Instrument Co., 103 Lafayette St., New York, N. Y.

R

Racine & Co., Jules, 20 West 17th St., New York, N. Y.
Radio City Products Co., 88 Park Place, New York, N. Y.
Ranco, Inc., 601 W. Fifth Ave., Columbus, Ohio
Randall, Frank E., 248 Ash Street, Waltham, Mass.
Rascher & Retzold, 829-835 Orleans St., Chicago, Ill.
Rawson Electrical Instrument Co., 110 Potter St., Cambridge, Mass.
Ray Pressure Snubber Co., Charlotte, North Carolina
Raytheon Mfg. Co., 190 Willow St., Waltham, Mass.
RCA Manufacturing Co., Inc., Camden, N. J.
Reed Small Tool Works, 40 Dewey St., Worcester, Mass.
Refinery Supply Company, 621 East 8th St., Tulsa, Okla.
Refrigerating Specialties Co., 728 So. Sacramento Blvd., Chicago, Ill.
Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland, Ohio
Reliance Instrument Co., 1135 West Van Buren St., Chicago, Ill.
Remler Co., Ltd., 2101 Bryant St., San Francisco, Calif.
Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill.
Reynolds Gas Regulator Co., Anderson, Ind.
Rhamstine, J. Thos., 500 East Woodbridge St., Detroit, Mich.
Rhodes, M. B., Inc., 30 Bartholomew Ave., Hartford, Conn.
Richardson Scale Co., Clifton, N. J.
Riehle Testing Machine Div., see American Machine & Metals, Inc.
Riverbank Laboratories, Geneva, Illinois
Robertshaw Thermostat Co., Youngwood, Penna.
Robertson & Co., John H., 1767 W. Armitage Ave., Chicago, Ill.
Robertson, 3rd, J. L., 117 Broad St., New York, N. Y.
Rochester Laboratory Supply Co., 537 Clinton Ave., North, Rochester, N. Y.
Rochester Mfg. Co., Rochester, N. Y.
Rockwell Co., Stanley P., 296 Homestead Ave., Hartford, Conn.
Roemer Drug Co., 606 N. Broadway, Milwaukee, Wisc.
Roller-Smith Co., 233 Broadway, New York, N. Y.
Ross Operating Valve Co., 6488 Epworth Blvd., Detroit, Mich.
R-S Products Corp., 4530 Germantown Ave., Philadelphia, Pa.
Rubicon Co., 29 N. 6th St., Philadelphia, Pa.
Ruehfel Co., George, 103-105 Menahan St., Brooklyn, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Rupp & Bowman Co., 315-319 Superior St., Toledo, Ohio
Ruska & Co., Inc., Walter, 2332 Bellaire Blvd., Houston, Texas
Ruth Glass Div., Kimble Glass Co., Conshohocken, Pa.

S

Sampsel Time Control, Inc., Mendota, Ill.
Sangamo Electric Co., 1022 Converse Ave., Springfield, Ill.
Sarco Company, Inc., 183 Madison Ave., New York, N. Y.
Sargent & Co., E. H., 155 East Superior St., Chicago, Ill.
Saxl Instrument Co., Industrial Trust Bldg., Providence, R. I.
Schaar & Company, 754 W. Mather St., Chicago, Ill.
Schade Valve Mfg. Co., 2527 N. Bodine St., Philadelphia, Pa.
Schaefer Bros. Co., 1059 West 11th St., Chicago, Ill.
Schaffer Poidometer Co., 2828 Smallman St., Pittsburgh, Pa.
Scherr Co., Inc., George, 128 Lafayette St., New York, N. Y.
Schettle's Frog Farm, Joe, 139 Sawyer Ave., Oshkosh, Wisc.
Schultheis Corp., E. W., 466 Wyckoff Ave., Brooklyn, N. Y.
Scientific Glass Apparatus Co., 49 West Ackerman St., Bloomfield, N. J.
Schutte & Koerting Co., 12th & Thompson Sts., Philadelphia, Pa.
Scientific Apparatus Co., 4 Landscape Ave., Yonkers, New York
Scientific Instrument Co., 1441 Walnut St., Berkeley, Calif.
Scientific Instrument Co., 535 West Larned St., Detroit, Mich.
Scientific Supplies Co., 123 Jackson St., Seattle, Wash.
Scott Co., Henry L., Blackstone & Calver Sts., Providence, R. I.
Seederer-Kohlbusch, Inc., 149 New York Ave., Jersey City, N. J.
Selas Company, 18th St. & Indiana Ave., Philadelphia, Pa.
Sensitive Research Instrument Co., 4545 Bronx Blvd., New York City, N. Y.
Service Recorder Co., 1422 Euclid Ave., Cleveland, O.
Shallcross Mfg. Co., 10 Jackson Ave., Collingdale, Pa.
Shawmut Engineering Co., 179 Freeport St., Boston, Mass.
Sheffield Gage Corp., 1517 E. 3 St., Dayton, O.
Sheldon & Co., E. H., Muskegon, Mich.
Shore Instrument & Mfg. Co., Van Wyck & Carl Sts., Jamaica, N. Y.
Shure Brothers, 225 W. Huron St., Chicago, Ill.
Sigma Instruments, Inc., 388 Trapelo Rd., Belmont, Mass.
Simpson Electric Co., 5216 Kinzie St., Austin Sta., Chicago, Ill.
Sjostrom Co., John E., 1711 N. Tenth St., Philadelphia, Pa.
Slocomb Co., J. T., 35 Oxford St., Providence, R. I.
Smith Meter Co., 1559 Fishburn St., Los Angeles, Calif.
Sødemann Heat & Power Co., 2300 Delmar Blvd., St. Louis, Mo.
Soltmann, Inc., E. G., 250 E. 43rd St., New York, N. Y.
Sorg Paper Co., Hamilton, Ohio
Southern Desk Company, Hickory, N. C.
Southwestern Electronics Labs., 1506 Lavaca Street, Austin, Texas
Specialty Glass Co., 536 Lake Shore Drive, Chicago, Illinois
Speedometer Service Co., 131 Fell St., San Francisco, Calif.
Speidel & Co., Chas. W., 112 N. 12th St., Philadelphia, Pa.

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Standard Electric Time Co., Springfield, Mass.
Standard Electrical Products Co., 317 Sibley St., St. Paul, Minn.
Standard Engineering Works, 289 North Main St., Pawtucket, R. I.
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Standard Scientific Supply Corp., 34-38 W. 4th St., New York, N. Y.
Standard Thermometer Corp., 217 W. Water Street, Syracuse, N. Y.
Standard Thermometer, Inc., 65 Shirley St., Boston, Mass.
Star Brass Mfg. Co., 104 E. Dedham St., Boston, Mass.
Star Compass Co., 110 Antwerp St., East Milton, Mass.
Starrett Co., L. S. Athol, Mass.
States Co., The, Hartford, Conn.
Steel City Testing Laboratory, 8843 Livernois Ave., Detroit, Michigan
Steele, Erick F., 135 E. 26th St., New York, N. Y.
Sterling Electric Motors, Inc., Telegraph Rd. & Atlantic Ave., Los Angeles, Calif.
Sterling Engineering Co., 3738 North Holton, Milwaukee, Wis.
Stets Company, 141 Milk St., Boston, Mass.
Stewart-Warner Corp., 1826 Diversey Parkway, Chicago, Ill.
Sticht & Co., Herman H., 27 Park Place, Corner of Church St., New York, N. Y.
Stickle Steam Specialties Co., 2215 Valley Ave., Indianapolis, Ind.
Stillman Co., M. J., Suite 800, 116 So. Michigan Ave., Chicago, Ill.
Stockton Profile Gauge Corp., 165 Jackson St., Lowell, Mass.
Stoelting Co., C. H., 424 N. Homan Ave., Chicago, Ill.
Stover-Lang Co., 280 Dover St., Boston, Mass.
Streeter-Amet Co., 1101 Ravenswood Ave., Chicago, Ill.

Stromberg Electric Co., 223-233 W. Erie St., Chicago, Illinois
Submarine Signal Co., 160 State St., Boston, Mass.
Smith Engineering Co., 4238 Lincoln Ave., Chicago, Ill.
Supreme Electric Products Corp., 77 Mt. Hope Ave., Rochester, N. Y.
Supreme Instrument Corp., Greenwood, Miss.
Sutor, Alfred, 200 Fifth Ave., New York, N. Y.
Syntron Company, Homer City, Pa.

T

Taber Instrument Co., 257 Goundry St., North Tonawanda, N. Y.
Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn, N. Y.
Tally Meter Co., 17 Elmwood Ave., Norwich, Conn.
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Taylor Instrument Cos., 95 Ames St., Rochester, N. Y.
Taylor Mfg. Corp., 2330 West Clybourn St., Milwaukee, Wisconsin
Tefft-Jackson, Inc., 2 Allens Ave., Providence, R. I.
Teschner-Quinn Corp., 89 North 11th St., Brooklyn, N. Y.
Testing Machines, Inc., 160 W. 34th St., New York, N. Y.
Testrite Instrument Co., 57 E. 11th St., New York, New York
Thermal Syndicate Ltd., 12 East 46th St., New York, N. Y.
Thomas Co., Arthur H., 230-2 4 South Seventh St., Philadelphia, Pa.
Thomas Clock Co., Seth, Thomaston, Conn.
Thompson Clock Co., H. C., Bristol, Conn.
Thordarson Electric Mfg. Co., 500 W. Huron St., Chicago, Ill.
Trommer, Henry, 911 Arch St., Philadelphia, Pa.
Thrush & Co., H. A., 23 E. Riverside St., Peru, Ind.
Thwing-Albert Instrument Co., 3324 Lancaster Ave., Philadelphia, Pa.
Tinsley Laboratories, 2035 Ashby Ave., Berkeley, Calif.
Tobe Deutschman Corp., Canton, Mass.
Toledo Scale Co., 3216 Monroe St., Toledo, Ohio
Torsion Balance Co., 92 Reade St., New York, N. Y.
Trane Company, La Crosse, Wisc.
Triangle Package Machinery Co., 905 N. Spaulding St., Chicago, Ill.
Trill Indicator Co., 38 E. South St., Corry, Pa.
Triner Sales Co., 1140 Merchandise Mart, Chicago, Ill.
Triplett Electrical Instrument Co., 135 E. College Ave., Bluffton, Ohio
Triumph Mfg. Co., 4017 W. Lake St., Chicago, Ill.

U

Uehling Instrument Co., 11 Vesper St., Paterson, New Jersey
Ulanet Co., George, 88 E. Kinney St., Newark, N. J.
Ulmer Co., J. C., 1791 E. 38th St., Cleveland, Ohio
Union Tool Company, Orange, Mass.
United Cinephone Corp., 43-37 33rd St. at Queens Blvd., Long Island City, New York
United Sound Engineering Co., 2233 University Ave., St. Paul, Minn.
United States Blue Print Paper Co., 207 So. Wabash Ave., Chicago, Ill.
U. S. Gauge Co., 44 Beaver St., New York, N. Y.
United Transformer Corp., 72 Spring St., New York, N. Y.
University Apparatus Co., 2229 McGee Ave., Berkeley, Calif.
Utility Mfg. Co., Squire & Kingham Aves., Cudahy, Wisconsin

V

Valpey Crystals, Box 321, Holliston, Mass.
Van Keuren Co., 12 Copeland St., Watertown, Mass.
Vapor Recovery Systems Co., 2820 Alameda St., Compton, Calif.
Vaughn-G. E. Witt Co., 4224 Hollis St., Oakland, Calif.
Veeder-Root, Inc., Sargent & Garden Sts., Hartford, Conn.
Vergilio Co., J. L., 504 Erie Building, Cleveland, Ohio
Veritas Firing System Co., P. O. Box 974, Trenton, N. J.
Victor Equipment Co., 844-50 Folsom St., San Francisco, Calif.
Viking Instrument Co., 37-46 Ninth St., Long Island City, N. Y.
Visco-Meter Corp., Grote Street, Buffalo, N. Y.
Vogt Machine Co., Henry, 10th & Ormsby Sts., Louisville, Ky.
Voland & Sons, Inc., New Rochelle, N. Y.

W

Wagner & Son, Carl H., 1941 North Albany Ave., Chicago, Illinois
Walker & Co., George T., 324 Fifth Ave., South, Minneapolis, Minn.
Wallace & Tiernan Products, Inc., Belleville, New Jersey
Walser Automatic Timer Co., 120 Lexington Ave., New York, N. Y.
Waltham Dial Gage Co., 85 Myrtle Street, Waltham, Mass.
Ward Leonard Electric Co., 37 South St., Mt. Vernon, New York
Ward's Natural Science Estab., Inc., 302 N. Goodman St., Rochester, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., S. E., Cleveland, Ohio
Warren-Knight Co., 136 North 12th St., Philadelphia, Pa.
Warren Telechron Co., Ashland, Mass.
Water Level Controls Co., 765 Hampden Ave., St. Paul, Minnesota
Water Leak Detector Co., 166 North Third St., Columbus, Ohio
Watts Regulator Co., 10 Embankment St., Lawrence, Mass.
Wayne Automatic Relay Co., 622 Wagner, Fort Wayne, Indiana
Weber Brothers Metal Works, 108 North Jefferson St., Chicago, Illinois
Weber Co., F., 1220 Buttonwood St., Philadelphia, Pa.
Welch Mfg. Co., W. M., 1515 Sedgwick St., Chicago, Illinois
West & Dodge Thread Gauge Co., Inc., 791 Tremont St., Boston, Mass.
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INSTRUMENTS' BOOK SHELF

Autographic Indicators for Internal Combustion Engines. By J. Okill. Edward Arnold & Co., London, 1938; Longmans Green & Co., New York, 1938. Cloth, 5 × 7½ inches, 88 pages. Price $1.80.

Professors of engineering, and generally, persons who spend their lives in or around engineering laboratories are likely to be infected sooner or later with the "Bacillus Indicatoris." The malady manifests itself in preoccupation with the history, construction, use, virtues and shortcomings of the indicator, and in an urge and restlessness to do something about it. The reviewer is also afflicted and therefore knows the symptoms. Once contracted the affliction usually lasts for life, with no known cure for it, though a temporary relief is obtained if the patient makes an invention, or writes a book or article, relating to the indicator.

The author of this book—a lecturer in engineering and superintendent of the mechanical engineering laboratories at the University of Liverpool—did both. In 1907 he invented the Okill maximum pressure indicator, a well-known instrument for determining the compression and combustion pressure in internal combustion engines, especially of the high-speed type. Now, more than thirty years later (notice the stubbornness of the malady!) he produces the book under review, which despite its small size contains a surprising amount of interesting and new information in this much-cultivated field. This book is not intended to be a complete, from the ground up, treatise on the indicator. It presupposes a familiarity of the reader with the construction and use of the instrument. Furthermore, the treatment is restricted to the normal, piston-type and pencil-recording instruments, omitting intentionally the micro-, optical and electrical types. It is rather a sound and interesting commentary on the construction and best use of the indicator, based on the long study and original investigations of the author. The first chapter deals with the early history of the indicator, the work of Watt, Southern, McNaught and some other early pioneers in those twilight years of engineering awakening in the early 19th century. Subsequent chapters treat piston friction and leakage; errors due to inertia and to faulty drum drive; testing of indicators statically and also at their working speed; development of the Okill maximum pressure indicator from its inception to its latest refined form; determination of compression ratio; indicated and brake mean effective pressure; indicator valves; out-of-phase diagrams, valve-lift diagrams, timing of injection and ignition in oil engines; description and illustration of the most used types of indicators.

The only criticism the reviewer can advance is that this book is too short; the reader feels that the author could tell more, if he had the time and space for it. Some of the illustrations are blurred. On the whole, however, the book is well worth reading and is a useful addition to the literature on indicators.

—K. J. DeJuhasz, *Assoc. Prof. Engineering Research, Pennsylvania State College.* (2.09)-**B**-

Der Indikator. By K. J. DeJuhasz and J. Geiger. Verlag Julius Springer, Berlin, 1938. Paper, 6⅛ × 9⅛ inches; ix + 293 pages. Price 27 RM (bound, 28.80 RM).

With the exception of the book by DeJuhasz published by *Instruments* in 1933, no complete treatise on indicators has appeared for many years—years during which many fundamental developments have been made—and the work under review is therefore both timely and welcome. It represents an interesting international collaboration of Professor DeJuhasz (Pennsylvania State College) and Dr.-Ing. Geiger (Augsburg).

A brief historical sketch of the development of the mechanical type of indicator opens the work. The authors point out that with increases in speed and pressures, the problem of design has changed from a purely kinematic to a dynamic one. The importance of high natural frequency is stressed and the limitations of the mechanical type are defined. A later section of the work is devoted to the dynamical questions involved. The authors state the conclusions that no further radical developments, except refinements of design and perfected workmanship, are to be looked for in mechanical indicators.

Following the section on mechanical indicators, optical and electrical types are taken up. The various physical principles employed are explained, and detailed descriptions of all the better-known standard makes are given. The advantages, limitations, applications, sources of errors, and calibration of the various types are ably discussed.

An interesting feature of the book is the amazing variety of applications which are described or at least mentioned. In addition to the conventional use for taking indicator diagrams on reciprocating engines, such applications as the study of powder pressures in guns, turbulent flow of gases in engine cylinders, knock testing, determination of vibrations, and many other uses, are described.

The comprehensive bibliography will be of great value to those who wish to pursue the subject further.

It is greatly to be hoped that an English translation of this excellent work will be made, so that it may become generally available to English-speaking readers. Although this book has only about 25% more pages than the one published by *Instruments*, it probably has twice the number of words (its format being larger) and goes into many more details.

—John A. Dent, *Professor of Mechanical Engineering, University of Pittsburgh.* (2.09)-**B**-

Härteprüfverfahren. By Erich Frankl. Verlag Cheme G.m.b.H., Berlin, 1937. Paper, 7 × 10¼ inches, 162 pages. Price 18.75 RM.

Under the able authorship of Dr. Franke there has been published, as a separate volume of 162 pages, a section of Gmelins Handbuch der anorganischen Chemie, entitled, Härteprüfverfahren.

These pages contain in compact form an exceptionally fine review of the work which has been done on hardness testing since the beginning and extending up to April 1937. The book divides itself into four quite distant sections. The first occupies 110 pages and deals with the various methods which have been employed in measuring hardness down to the present day. From page 110 to 130 a great deal of attention is paid to comparisons of hardness numbers as determined by various instruments. From page 130 on to 150 there is given an excellent study of the relations which exist between hardness and many of the physical properties. For instance, the relation between hardness and moduli of elasticity, hardness and tensile strength, hardness and yield strength and other related physical properties. From page 150 on to the end are arranged a series of compilations. Pages 150-154 contains a bird's-eye view of the leading methods for measuring hardness in which is given a concise statement of the advantages and disadvantages of each system. One is not always in accord with these judgments; nevertheless, they give a consecutive review of what has been described in greater detail on pages 1-110 and these comments give a single viewpoint.

Pages 155-156 list in alphabetical order about 150 different names and methods which have been associated with the art of hardness testing.

Anyone who has worked in the field of hardness testing is always glad to have helps for his bibliography of the subject of hardness. Dr. Franke has added an excellent array of references and has brought a survey of the literature down to April 1937.

This small book of Dr. Franke is a distinct contribution to a field noted for its lack of books concerning hardness. The following list comprises the books published thus far:

P. Ludwik. Die Kegelprobe. Ein neues Verfahren zur Härtebestimmung von Materialien, Julius Springer, Berlin, 1908. (Out of Print)

V. Pöschl. Die Härte der festen Körper. Verlag von Theodor Steinkopff, Dresden, 1909, 85 pages.

H. O'Neill. The Hardness of Metals and Its Measurements, Chapman and Hall, Ltd., London, 1934, 292 pages. (See Review, Instruments, Vol. 8, 1935, pages 50-51.)

F. C. Lea. Hardness of Metals. Charles Griffin and Company, Ltd. London, 1936. 141 pages.

Dr. Franke's book is a small volume, which those interested in the subject of hardness and its measurements will desire to add to their library.

—S. R. Williams, *Professor of Physics, Amherst College.* (2.10)-**B**-

Spectrochemical Abstracts 1933-1937. By F. Twyman. Adam Hilger, Ltd., London, June 1938. Paper, 9½ × 6 inches, 52 pages. Price 4 s.

This 52-page bibliography, with abstracts of more than 200 papers on spectrochemical analysis, covers the most important years of the development of the subject. Part I contains a list of references and authors arranged alphabetically under the authors' names. Part II lists substances analyzed and some of the elements determined. The papers are grauped under the headings: Biological Material, Earths, Electrodes, Gases, Industrial Materials, Liquids, Metals and Alloys, Minerals, Non-metals, Apparatus, Methods, and General. A list of the more important books on the subject (1931-1937) is appended. The abstracts are models, showing the salient features of the papers and enabling the reader to judge whether or not he needs to consult the original. This small book of abstracts is capable of showing the beginner nearly all that can be done in spectrochemical analysis and the methods used for emission spectra. Absorption spectra receive slight attention. Every teacher of the subject will wish a copy of this book, and no worker in this field can afford to be without it.

—Kelvin Burns, *Astronomer, Allegheny Observatory, Pittsburgh.* (7.5)-**B**-

Handbook of the Collections Illustrating Time Measurement. F. A. B. Ward. His Majesty's Stationery Office, London, 1937. Paper, 6 × 9¾ inches. Part I, Historical Review, 66 pages. Price 1s. 6d. Part II, Descriptive Catalogue, 94 pages. Price 2s.

Part I consists of a brief review of the history of time measurement with notes on the principles used in measuring time. Part II contains detailed descriptions of the objects exhibited in the Time Measurement Section of the Science Museum. Some of the objects in the collection have been photographed and in these cases the identification numbers of the negatives are given. Prints and lantern slides from these negatives may be purchased from the Museum.

—Richard Rimbach (2.02)-**B**-

Trockengleichrichter: Theorie, Aufbau und Anwendung. (Dry Type Rectifiers) By Karl Maier. R. Oldenbourg, Munich, 1938. Cloth, 6½ × 9½ inches, 314 pages. Price 8.80 RM.

The ever-increasing industrial and commercial applications of dry rectifiers clearly indicate that they are no longer incidental to electrical circuits, but are firmly established as an essential piece of electrical equipment much in the same manner as the radio tube has found its place in industrial equipment. Up to the present there has been no text book on the subject of dry rectifiers, and the scattered literature, al-

though abundant, has been primarily of interest to the physicist rather than the practical engineer. This book fulfills the urgent need for a treatise on the subject, particularly from the engineering standpoint.

The author developed an improved selenium rectifier and, as director of an industrial rectifier laboratory, had occasion to gain first hand information on the numerous problems involved in this new field. Having had more experience with the selenium rectifier, he naturally discusses this more fully than either the cuprous oxide or cupric sulfide rectifier. However, he attempts to present data on all the available types and strives to make the broadest coverage. His vast experience has been reflected in the thorough manner in which he treats the methods of calculation involved in dry rectifier circuits. The rectifier characteristics and methods of assembly are given detailed consideration, although the procedure of manufacture might well have been amplified. A considerable portion of the book is devoted to practical applications illustrated with numerous photographs of equipment and installations. Because of the lack of a sound theoretical explanation of the mechanism of rectification, the author has sketched the numerous proposals suggested to account for this action, and includes a rather extensive bibliography for a more detailed investigation. The mathematics has been reduced to a minimum, and is frequently supplanted by graphical methods. The treatise should serve as a ready reference book to the engineer concerned with the application of dry rectifiers.

—C. C. Hein, *Research Laboratories, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.* (4)-**B-**

Actualités Scientifiques et Industrielles. Exposés d'Astronomie Stellaire. Edited by Henri Mineur.

Vol. VI. **Les Parallaxes Dynamiques des Etoiles Doubles.** By M. D. Barbier. Hermann et Cie, Paris, 1936. Paper, 6½ × 10 inches, 32 pages, Price 10f.

This paper gives the derivation of the formulas for computing the parallax of a double star if the orbit is known; or, if sufficient relative motion of the components of the pair has been observed. The nature and magnitude of the errors are discussed, and the relationship between the real and computed statistical parallaxes is found. The paper concludes with a list of all important references to the subject.

Vol. VII. **Théorie de L'Emission de la Lumière des Nébuleuses.** By H. Zanstra. 40 pages. Price 15f.

The author gives formula for the interaction of light, electrons and atoms. He concludes that the assumption of black body radion emitted by early type stars and absorbed by the nebulae is sufficient to explain the emission of lines of H, He I, and the "nebulium" lines. Some other system must be involved in the production of the lines of He II.

Exposés d'Histoire et Philosophie des Sciences. Edited by Abel Rey.

Vol. VI. **L'Oeuvre Astronomique de Gassendi.** By Pierre Humbert. 32 pages. Price 8f.

The active observations of Gassendi covered that interesting and fruitful period which extended from the first astronomical observation of Galileo to the invention of the micrometer (1610-1667). Gassendi became a master of every type of astronomical work that was done in this period, and did much to improve instruments. The astronomical knowledge at the time of his death was based very largely on his observations. But his great contribution to the world of science was his development of the modern scientific method. An ardent and tireless observer, he never discovered anything of note in that age of discovery. But he made the most accurate possible observations of every type of phenomenon. And his feat in being the first to see the planet mercury on the face of the sun is a tribute to his ability. The planet was thought to be much larger than it is, and all but Gassendi missed it. This might well be classed as an important discovery. But the influence on his contemporaries and successors which his genius for method exerted is of far more value than anything he ever discovered.

—Kelvin Burns, *Astronomer, Allegheny Observatory, Pittsburgh.* (9)-**B-**

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Dielectric Phenomena in High Voltage Cables. By D. M. Robinson. 1936. Cloth, 5½ x 8½ inches, 186 pages, $5.00. (Only 50 copies left) Special price **$3.00**

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Automatic Protection of A. C. Circuits. By G. W. Stubbings. "Material logically presented in lucid manner . . . concise treatment of a subject heretofore requiring extensive reading in diverse publications."—Perry A. Borden. 1935. Cloth, 5½ x 8¾ inches, 293 pages, $5.00. (Only 41 copies left) Special price **$3.00**

Mercury Arc Rectifier Practice. By Frederic Charles Orchard. "This book is one there need be no hesitation in recommending to anyone concerned with the practical operation of rectifier plants." Electrical Times. 1936. Cloth, 5½ x 8½ inches, 235 pages, $5.00. (Only 99 copies left) Special price **$3.00**

The Engine Indicator—Its Design, Theory and Special Applications. By K. J. DeJuhaz. A mine of information for all engineers who have to investigate forces and motions—not only in engines but in many other applications. Cloth, 5½ x 8¼ inches, 343 pages, $3.75. (Only 141 copies left) Special price **$2.00**

Cathode Ray Oscillography. By J. T. MacGregor-Morris and J. A. Henley. 1936. Cloth, 5½ x 8½ inches, 250 pages, $6.00. (Only 8 copies left) Special price **$4.00**

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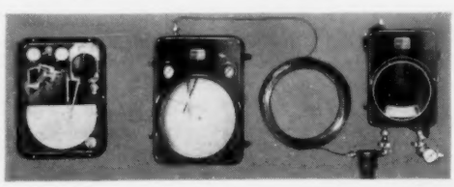

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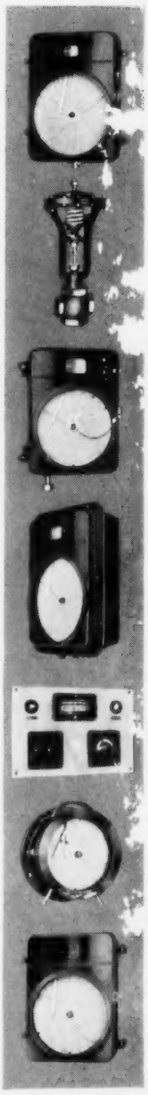

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